



Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.7

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Text Part Number: 78EE117C99-1539250589

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1.3 libdrm 2.4.45

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1.4 txw2 2.3.3

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1.5 util-linux 2.20.0

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*/

NR START END SECTORS SIZE NAME UUID

```
1 32 7679 7648 3.7M 8f8378c0-01
2 7680 16383 8704 4.3M 8f8378c0-02
5 7936 12799 4864 2.4M
6 12544 16127 3584 1.8M
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1.6 cairo 1.14.2

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1.7 coreutils 8.30 3ubuntu2

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Arne Beer <arne@twobeer.de>
Billy Robert O'Neal III <billy.oneal@gmail.com> <bion@microsoft.com>
Chris Kennelly <ckennelly@google.com> <ckennelly@ckennelly.com>
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Ismael Jimenez Martinez <ismael.jimenez.martinez@gmail.com>
Jern-Kuan Leong <jernkuan@gmail.com>
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Joao Paulo Magalhaes <joaoppmagalhaes@gmail.com>
John Millikin <jmillikin@stripe.com>
Jussi Knuutila <jussi.knuutila@gmail.com>
Kai Wolf <kai.wolf@gmail.com>
Kishan Kumar <kumar.kishan@outlook.com>
Kaito Udagawa <umireon@gmail.com>
Lei Xu <eddyxu@gmail.com>
Matt Clarkson <mattyclarkson@gmail.com>
Maxim Vafin <maxvafin@gmail.com>
Nick Hutchinson <nshutchinson@gmail.com>
Oleksandr Sochka <sasha.sochka@gmail.com>
Pascal Leroy <phl@google.com>
Paul Redmond <paul.redmond@gmail.com>
Pierre Phaneuf <pphaneuf@google.com>
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1.10 rsyslog 7.6.7

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1.18 jansi-native 1.8

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```
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860186_1643019499.32/0/jansi-native-1-8-sources-
jar/org/fusesource/jansi/internal/CLibrary.java
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1.19 Icms 2.11

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* @version 3.0 (December 2000)

*

* Optimised ANSI C code for the Rijndael cipher (now AES)

*

* @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>

* @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/Headers.java

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/JdkZlibDecoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/FastLz.java

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Bzip2HuffmanStageEncoder.java
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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ReferenceMap.java

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/CachingClassResolver.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/SnappyFrameDecoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Snappy.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/CompatibleMarshallingEncoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ThreadLocalMarshallerProvider.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ChannelBufferByteInput.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/CompatibleObjectEncoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/WeakReferenceMap.java

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/string/LineSeparator.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/ByteBufChecksum.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/DatagramPacketDecoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/string/LineEncoder.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/CodecOutputList.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/compression/CompressionUtil.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/DateFormatter.java
* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/DatagramPacketEncoder.java
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```

```

* under the License.
*/
/**
* A decoder that splits the received { @link ByteBuf}s dynamically by the
* value of the length field in the message. It is particularly useful when you
* decode a binary message which has an integer header field that represents the
* length of the message body or the whole message.
* <p>
* { @link LengthFieldBasedFrameDecoder} has many configuration parameters so
* that it can decode any message with a length field, which is often seen in
* proprietary client-server protocols. Here are some example that will give
* you the basic idea on which option does what.
*
* <h3>2 bytes length field at offset 0, do not strip header</h3>
*
* The value of the length field in this example is <tt>12 (0x0C)</tt> which
* represents the length of "HELLO, WORLD". By default, the decoder assumes
* that the length field represents the number of the bytes that follows the
* length field. Therefore, it can be decoded with the simplistic parameter
* combination.
* <pre>
* <b>lengthFieldOffset</b> = <b>0</b>
* <b>lengthFieldLength</b> = <b>2</b>
* lengthAdjustment = 0
* initialBytesToStrip = 0 (= do not strip header)
*
* BEFORE DECODE (14 bytes)      AFTER DECODE (14 bytes)
* +-----+-----+ +-----+-----+
* | Length | Actual Content |---->| Length | Actual Content |
* | 0x000C | "HELLO, WORLD" |   | 0x000C | "HELLO, WORLD" |
* +-----+-----+ +-----+-----+
* </pre>
*
* <h3>2 bytes length field at offset 0, strip header</h3>
*
* Because we can get the length of the content by calling
* { @link ByteBuf#readableBytes()}, you might want to strip the length
* field by specifying <tt>initialBytesToStrip</tt>. In this example, we
* specified <tt>2</tt>, that is same with the length of the length field, to
* strip the first two bytes.
* <pre>
* lengthFieldOffset = 0
* lengthFieldLength = 2
* lengthAdjustment = 0
* <b>initialBytesToStrip</b> = <b>2</b> (= the length of the Length field)
*
* BEFORE DECODE (14 bytes)      AFTER DECODE (12 bytes)
* +-----+-----+ +-----+

```



```

* | Length | Actual Content |---->| Actual Content |
* | 0x000C | "HELLO, WORLD" | | "HELLO, WORLD" |
* +-----+-----+ +-----+
* </pre>
*
* <h3>2 bytes length field at offset 0, do not strip header, the length field
* represents the length of the whole message</h3>
*
* In most cases, the length field represents the length of the message body
* only, as shown in the previous examples. However, in some protocols, the
* length field represents the length of the whole message, including the
* message header. In such a case, we specify a non-zero
* <tt>lengthAdjustment</tt>. Because the length value in this example message
* is always greater than the body length by <tt>2</tt>, we specify <tt>-2</tt>
* as <tt>lengthAdjustment</tt> for compensation.
* <pre>
* lengthFieldOffset = 0
* lengthFieldLength = 2
* <b>lengthAdjustment</b> = <b>-2</b> (= the length of the Length field)
* initialBytesToStrip = 0
*
* BEFORE DECODE (14 bytes)      AFTER DECODE (14 bytes)
* +-----+-----+ +-----+
* | Length | Actual Content |---->| Length | Actual Content |
* | 0x000E | "HELLO, WORLD" | | 0x000E | "HELLO, WORLD" |
* +-----+-----+ +-----+
* </pre>
*
* <h3>3 bytes length field at the end of 5 bytes header, do not strip header</h3>
*
* The following message is a simple variation of the first example. An extra
* header value is prepended to the message. <tt>lengthAdjustment</tt> is zero
* again because the decoder always takes the length of the prepended data into
* account during frame length calculation.
* <pre>
* <b>lengthFieldOffset</b> = <b>2</b> (= the length of Header 1)
* <b>lengthFieldLength</b> = <b>3</b>
* lengthAdjustment = 0
* initialBytesToStrip = 0
*
* BEFORE DECODE (17 bytes)      AFTER DECODE (17 bytes)
* +-----+-----+-----+ +-----+-----+-----+
* | Header 1 | Length | Actual Content |---->| Header 1 | Length | Actual Content |
* | 0xCAFE | 0x00000C | "HELLO, WORLD" | | 0xCAFE | 0x00000C | "HELLO, WORLD" |
* +-----+-----+-----+ +-----+-----+-----+
* </pre>
*
* <h3>3 bytes length field at the beginning of 5 bytes header, do not strip header</h3>

```



```

* We have to count the length of HDR1 and Length into <tt>lengthAdjustment</tt>.
* Please note that we don't need to take the length of HDR2 into account
* because the length field already includes the whole header length.
* <pre>
* lengthFieldOffset = 1
* lengthFieldLength = 2
* <b>lengthAdjustment</b> = <b>-3</b> (= the length of HDR1 + LEN, negative)
* <b>initialBytesToStrip</b> = <b> 3</b>
*
* BEFORE DECODE (16 bytes)           AFTER DECODE (13 bytes)
* +-----+-----+-----+-----+ +-----+-----+
* | HDR1 | Length | HDR2 | Actual Content |---->| HDR2 | Actual Content |
* | 0xCA | 0x0010 | 0xFE | "HELLO, WORLD" |   | 0xFE | "HELLO, WORLD" |
* +-----+-----+-----+-----+ +-----+-----+
* </pre>
* @see LengthFieldPrepender
*/

```

Found in path(s):

```

* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
jar/io/netty/handler/codec/LengthFieldBasedFrameDecoder.java
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*/
/**
* Enumeration of supported Base64 dialects.
*
* <p>
* The internal lookup tables in this class has been derived from
* <a href="http://iharder.sourceforge.net/current/java/base64/">Robert Harder's Public Domain
* Base64 Encoder/Decoder</a>.

```

*/

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/Base64Dialect.java

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* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DefaultHeadersImpl.java

* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CharSequenceValueConverter.java

* /opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ValueConverter.java

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*/

/*

```
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*/
/**
* Utility class for { @link ByteBuffer } that encodes and decodes to and from
* Base64 notation.
* <p>
* The encoding and decoding algorithm in this class has been derived from
* Robert Harder's Public Domain
* Base64 Encoder/Decoder</a>.
*/
```

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```
*/opt/ws_local/PERMITS_SQL/1072948336_1595240763.12/0/netty-codec-4-1-51-final-sources-
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```

1.25 gnutls 3.6.13 2ubuntu1.7

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Upstream Authors (from AUTHORS file):

The authors list is autogenerated from the git history; sorted by number of commits

Nikos Mavrogiannopoulos <nnav at gnutls.org>
Simon Josefsson <jas at josefsson.org>
Dmitry Baryshkov <dbaryshkov at gmail.com>
Tim Rhsen <tim.ruehsen at gmx.de>
Daiki Ueno <ueno at gnu.org>
Ludovic Courts <ludo at gnu.org>
Timo Schulz <twoaday at gnutls.org>
Jonathan Bastien-Filiatrault <joe at x2a.org>
Alon Bar-Lev <alon.barlev at gmail.com>
Andreas Metzler <ametzler at debian.org>
Tom Vrancken <dev at tomvrancken.nl>
Martin Storsjo <martin at martin.st>
Tim Kosse <tim.kosse at filezilla-project.org>
Simo Sorce <simo at redhat.com>
Daniel Kahn Gillmor <dkg at fifthhorseman.net>
Fabian Keil <fk at fabiankeil.de>
Fabio Fiorina <fiorinaf at gnutls.org>
Stef Walter <stefw at redhat.com>
Armin Burgmeier <armin at arbur.net>
Andrew McDonald <admcd at gnutls.org>
Alex Gaynor <alex.gaynor at gmail.com>
Martin Ukrop <mukrop at redhat.com>
Jaak Ristioja <jaak.ristioja at cyber.ee>
Anderson Toshiyuki Sasaki <ansasaki at redhat.com>
Attila Molnar <attilamolnar at hush.com>
Hugo Beauze-Luyssen <hugo at beauee.fr>
Jakub Jelen <jjelen at redhat.com>
Martin Sucha <anty.sk+git at gmail.com>
Stefan Berger <stefanb at linux.ibm.com>
Ander Juaristi <a at juaristi.eus>
David Woodhouse <dwmw2 at infradead.org>
Jan Vcelak <jan.vcelak at nic.cz>
Kevin Cernekee <cernekee at gmail.com>
Stefan Srensen <stefan.sorensen at spectralink.com>
Adam Sampson <ats at offog.org>

Alfredo Pironti <alfredo at pironti.eu>
Brad Hards <bradh at frogmouth.net>
Daniel Lenski <dlenski at gmail.com>
Dimitri John Ledkov <xnox at ubuntu.com>
Fiona Klute <fiona.klute at gmx.de>
Michael Weiser <michael.weiser at gmx.de>
Patrick Pelletier <code at funwithsoftware.org>
Rolf Eike Beer <eike at sf-mail.de>
Sjoerd Simons <sjoerd.simons at collabora.co.uk>
Stefan Bhler <stbuehler at web.de>
Thomas Klute <thomas2.klute at uni-dortmund.de>
Wolfgang Meyer zu Bergsten <w.bergsten at sirrix.com>
Christian Grothoff <christian at grothoff.org>
Daniel P. Berrange <berrange at redhat.com>
Gustavo Zacarias <gustavo at zacarias.com.ar>
Ji Klime <jklimes at redhat.com>
Karsten Ohme <k_o_ at users.sourceforge.net>
Kurt Roeckx <kurt at roeckx.be>
Peter Wu <peter at lekensteyn.nl>
Thierry Quemerai <tquemerai at awox.com>
Alessandro Ghedini <alessandro at ghedini.me>
Alex Monk <krenair at gmail.com>
David Caldwell <david at porkrind.org>
Diego Elio Petten <flameeyes at flameeyes.eu>
Elta Koepp <alexi_2019 at protonmail.com>
Fabrice Fontaine <fontaine.fabrice at gmail.com>
Giuseppe Scrivano <gscrivano at gnu.org>
Hubert Kario <hkario at redhat.com>
Ilya Tumaykin <itumaykin at gmail.com>
James Bottomley <James.Bottomley at HansenPartnership.com>
Karl Tarbe <karl.tarbe at cyber.ee>
Ke Zhao <kzhao at redhat.com>
Mark Brand <mabrand at mabrand.nl>
Matthias-Christian Ott <ott at mirix.org>
Maya Rashish <coypu at sdf.org>
Michael Catanzaro <mcatanzaro at gnome.org>
Michael Catanzaro <mcatanzaro at igalia.com>
Micha Grny <mgorny at gentoo.org>
Petr Psa <petr.pisar at atlas.cz>
Roman Bogorodskiy <bogorodskiy at gmail.com>
Stephan Mueller <smueller at chronox.de>
Steve Dispensa <dispensa at phonefactor.com>
Vitezslav Cizek <vcizek at suse.com>
nia <nia at NetBSD.org>
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Alban Crequy <alban.crequy at collabora.co.uk>
Aleksi Nikiforov <darktemplar at basealt.ru>
Alexander Kanavin <alex.kanavin at gmail.com>

Alexandre Bique <bique.alexandre at gmail.com>
Andreas Metzler <gitlab at bebt.de>
Andreas Schneider <asn at samba.org>
Andreas Schwab <schwab at suse.de>
Avinash Sonawane <rootkea at gmail.com>
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Bernhard M. Wiedemann <bwiedemann at suse.de>
Bjoern Jacke <bjacke at samba.org>
Bjrn Jacke <bjacke at samba.org>
Bjrn Christensen <bhc at insight.dk>
Carolin Latze <latze at angry-red-pla.net>
Chen Hongzhi <hongzhi.chen at me.com>
Chris Barry <chris at barry.im>
Colin Walters <walters at verbum.org>
Dan Fandrich <dan at coneharvesters.com>
Daniel Schaefer <git at danielschaefer.me>
David Walker <david.walker at vcatechnology.com>
David Weber <dave at veryflatcat.com>
Edward Stangler <estangler at bradmark.com>
Elias Pipping <pipping at exherbo.org>
Elta Koepp <elta_koepp at gmail.com>
Frank Morgner <morgner at informatik.hu-berlin.de>
Gnther Deschner <gd at samba.org>
Hani Benhabiles <kroosec at gmail.com>
Ilya V. Matveychikov <i.matveychikov at securitycode.ru>
Jared Wong <jaredlwong at gmail.com>
Jason Spafford <>nullprogrammer at gmail.com>
Jay Foad <jay.foad at gmail.com>
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Jens Lechtenboerger <jens.lechtenboerger at fsfe.org>
Jussi Kukkonen <jussi.kukkonen at intel.com>
Kenneth J. Miller <ken at miller.ec>
Lili Quan <13132239506 at 163.com>
Lucas Fisher <lucas.fisher at gmail.com>
Ludwig Nussel <ludwig.nussel at suse.de>
Luis G.F <luisgf at gmail.com>
Luke Dashjr <luke-jr+git at utopios.org>
Maciej S. Szmigiero <mail at maciej.szmigiero.name>
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Miroslav Lichvar <mlichvar at redhat.com>

Nick Alcock <nick.alcock at oracle.com>
Nicolas Dufresne <nicolas.dufresne at collabora.com>
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Ricardo M. Correia <rcorreia at wizy.org>
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Rowan Thorpe <rowan at rowanthorpe.com>
SUMIT AGGARWAL <aggarwal.s at samsung.com>
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Simon Arlott <sa.me.uk>
Steve Lhomme <robux4 at ycbcr.xyz>
Thomas Klausner <wiz at NetBSD.org>
Tobias Polzer <tobias.polzer at fau.de>
Tomas Hoger <thoger at redhat.com>
Tristan Matthews <le.businessman at gmail.com>
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Yuriy M. Kaminskiy <yumkam at gmail.com>
sskaje <sskaje at gmail.com>
ukasz Stelmach <stlman at poczta.fm>

The translators list is autogenerated from po file history

Anders Jonsson
Benno Schulenberg
Felipe Castro
Francisco Javier Serrador
Jakub Bogusz
Jorma Karvonen
Milo Casagrande
Mingye Wang (Arthur2e5)
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lib/accelerated/x86/elf/aes-ssse3-x86.s
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Author: Rusty Russell <rusty@rustcorp.com.au>

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fuzz/gnutls_ocsp_resp_parser_fuzzer.c fuzz/gnutls_server_fuzzer.c
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fuzz/gnutls_psk_server_fuzzer.c
fuzz/gnutls_psk_client_fuzzer.c fuzz/gnutls_srp_client_fuzzer.c
fuzz/gnutls_srp_server_fuzzer.c tests/cert-tests/certtool-verify-profiles

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- * For English description, check RFC 5830.
- * S-Boxes are expanded from the tables defined in RFC4357:
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- * English description in RFC 5831.

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Constant-time SSSE3 AES core implementation.

version 0.1

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By Mike Hamburg (Stanford University), 2009

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1.26 cryptsetup 2.3.6

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1.28 apr-util 1.6.1

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1.29 open-ldap 2.4.58

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1.30 dhcp 4.1

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* configure.ac, Makefile.am: The original versions were derived from the ones in the XML Catalog Manager project, version 2.2.

Author: Julio Merino <jmmv@users.sourceforge.net>

* atf-c/ui.c: The format_paragraph and format_text functions were derived from the ones in the Monotone project, revision 3a0982da308228d796df35f98d787c5cff2bb5b6.

Author: Julio Merino <jmmv@NetBSD.org>

* atf-c++/detail/io.hpp, atf-c++/detail/io.cpp, atf-c++/detail/io_test.cpp: These files were derived from the file_handle, systembuf, pipe and pistream classes and tests found in the Boost.Process library.

Author: Julio Merino <jmmv84@gmail.com>

* admin/check-style.sh, admin/check-style-common.awk, admin/check-style-cpp.awk, admin/check-style-shell.awk: These files, except the first one, were first implemented in the Buildtool project. They were later adapted to be part of Boost.Process and, during that process, the shell script was created.

Author: Julio Merino <jmmv84@gmail.com>

```
=====
vim: filetype=text:textwidth=75:expandtab:shiftwidth=2:softtabstop=2
```

```
<!--
```

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-
```

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```

```
- file, You can obtain one at http://mozilla.org/MPL/2.0/.
```

```
-->
```

```
<!-- $Id$ -->
```

<!-- Generate ISC copyright comments from Docbook copyright metadata. -->

```
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:xi="http://www.w3.org/2001/XInclude"
xmlns:db="http://docbook.org/ns/docbook">

<xsl:template name="isc.copyright.format">
  <xsl:param name="text"/>
  <xsl:value-of select="$isc.copyright.leader"/>
  <xsl:value-of select="normalize-space(substring-before($text, '&#10;'))"/>
  <xsl:text>&#10;</xsl:text>
  <xsl:variable name="rest" select="substring-after($text, '&#10;')"/>
  <xsl:if test="translate($rest, '&#9;&#32;', '')">
    <xsl:call-template name="isc.copyright.format">
      <xsl:with-param name="text" select="$rest"/>
    </xsl:call-template>
  </xsl:if>
</xsl:template>

<xsl:variable name="isc.copyright.text">
  <xsl:text>
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    License, v. 2.0. If a copy of the MPL was not distributed with this
    file, You can obtain one at http://mozilla.org/MPL/2.0/.
  </xsl:text>
</xsl:variable>

<xsl:variable name="isc.copyright">
  <xsl:call-template name="isc.copyright.format">
    <xsl:with-param name="text">
      <xsl:for-each select="book/info/copyright | refentry/docinfo/copyright">
        <xsl:text>Copyright (C) </xsl:text>
        <xsl:call-template name="copyright.years">
          <xsl:with-param name="years" select="year"/>
        </xsl:call-template>
        <xsl:text> </xsl:text>
        <xsl:value-of select="holder"/>
        <xsl:value-of select="$isc.copyright.breakline"/>
        <xsl:text>&#10;</xsl:text>
      </xsl:for-each>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>
</xsl:stylesheet>
```

<!--

- Local variables:

- mode: sgml

- End:

-->

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1.31 jakarta-transaction-api 1.3.3

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1.33 acpid 2.0.11

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1.37 jakarta-persistence-api 2.2.3

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1.41 python 3.9.12

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

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

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same

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

All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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Thanks to the many outside volunteers who have worked under Guido's direction to make these releases possible.

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1.44 netty-transport-native-unix-common

4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/package-info.java

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* /opt/ws_local/PERMITS_SQL/1075084034_1596044782.67/0/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_util.c
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1.45 jaxb-runtime 2.3.3

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Found in path(s):

* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-handler-proxy/pom.xml

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

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*/

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-jar/io.netty.handler.proxy.HttpProxyHandler.java

* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-

```
jar/io/netty/handler/proxy/ProxyHandler.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/package-info.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/Socks4ProxyHandler.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/ProxyConnectionEvent.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/Socks5ProxyHandler.java
* /opt/ws_local/PERMITS_SQL/1077639653_1597066896.9/0/netty-handler-proxy-4-1-51-final-sources-
jar/io/netty/handler/proxy/ProxyConnectException.java
```

1.47 hibernate-commons-annotations

5.1.0.Final

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1.48 mail 1.6.5

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1.51 e2fsprogs 1.43.1

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*/

Index: tdbsa/tdb.c

=====

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

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

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

*/

/*

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- + trivial database library - standalone version

- trivial database library - private includes
-
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23-June-2007

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```
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```

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```
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```


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

That's all there is to it!

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

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

<http://sourceforge.net/projects/e2fsprogs>

Upstream Author: Theodore Ts'o <tytso@mit.edu>

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

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

From the original distribution:

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#

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

#

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

#

BSDLIB_VERSION = 1.0

BSDLIB_IMAGE = libce

```

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

all:: image

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

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

image: $(BSD_LIB)

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

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

install-strip: install

install-shlibs-strip: install-shlibs

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

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

```

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

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

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Gadi Oxman, August 1995

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1.53 jq 1.4

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1.54 linux-kernel 4.4.225

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```
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```

```
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Contributors to bttv:

Michael Chu <mmchu@pobox.com>
AverMedia fix and more flexible card recognition

Alan Cox <alan@lxorguk.ukuu.org.uk>
Video4Linux interface and 2.1.x kernel adaptation

Chris Kleitsch
Hardware I2C

Gerd Knorr <krxel@cs.tu-berlin.de>
Radio card (ITT sound processor)

bigfoot <bigfoot@net-way.net>
Ragnar Hojland Espinosa <ragnar@macula.net>
ConferenceTV card

+ many more (please mail me if you are missing in this list and would like to be mentioned)

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/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

*

* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

* <http://www.hypermall.com/>

* 10/1/97 - commented out CFG_PHYIE bit - we don't care when the PHY

* interrupts us (except possibly for removal/insertion of the cable?)

* 10/4/97 - began heavy inline documentation of the code. Corrected typos

* and spelling mistakes.

* 10/5/97 - added code to handle PHY interrupts, disable PHY on

* loss of link, and correctly re-enable PHY when link is

* re-established. (put back CFG_PHYIE)

*

* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.

*

* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997

*

```

* Linux driver for the IDT77201 NICStAR PCI ATM controller.
* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;
* see init_nicstar() for PHY initialization to change this. This driver
* expects the Linux ATM stack to support scatter-gather lists
* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.
*
* Implementing minimal-copy of received data:
* IDT always receives data into a small buffer, then large buffers
* as needed. This means that data must always be copied to create
* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
* Fix is simple: make large buffers large enough to hold entire
* SDU, and leave <small_buffer_data> bytes empty at the start. Then
* copy small buffer contents to head of large buffer.
* Trick is to avoid fragmenting Linux, due to need for a lot of large
* buffers. This is done by 2 things:
* 1) skb->destructor / skb->atm.recycle_buffer
*    combined, allow nicstar_free_rx_skb to be called to
*    recycle large data buffers
* 2) skb_clone of received buffers
* See nicstar_free_rx_skb and linearize_buffer for implementation
* details.
*
*
*
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*
* M. Welsh, 6 July 1996
*
*
*/

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Thanks go to the following people for patches and contributions:

Michael Hunold <m.hunold@gmx.de>
for the initial saa7146 driver and its recent overhaul

Christian Theiss
for his work on the initial Linux DVB driver

Marcus Metzler <mocm@metzlerbros.de>
Ralph Metzler <rjkm@metzlerbros.de>
for their continuing work on the DVB driver

Michael Holzt <kju@debian.org>
for his contributions to the dvb-net driver

Diego Picciani <d.picciani@novacomp.it>
for CyberLogin for Linux which allows logging onto EON
(in case you are wondering where CyberLogin is, EON changed its login procedure and CyberLogin is no longer used.)

Martin Schaller <martin@smurf.franken.de>

for patching the cable card decoder driver

Klaus Schmidinger <Klaus.Schmidinger@cadsoft.de>
for various fixes regarding tuning, OSD and CI stuff and his work on VDR

Steve Brown <sbrown@cortland.com>
for his AFC kernel thread

Christoph Martin <martin@uni-mainz.de>
for his LIRC infrared handler

Andreas Oberritter <obi@linuxtv.org>
Dennis Noermann <dennis.noermann@noernet.de>
Felix Domke <tmbinc@elitedvb.net>
Florian Schirmer <jolt@tuxbox.org>
Ronny Strutz <3des@elitedvb.de>
Wolfram Joost <dbox2@frokaschwei.de>
...and all the other dbox2 people
for many bugfixes in the generic DVB Core, frontend drivers and
their work on the dbox2 port of the DVB driver

Oliver Endriss <o.endriss@gmx.de>
for many bugfixes

Andrew de Quincey <adq_dvb@lidskialf.net>
for the tda1004x frontend driver, and various bugfixes

Peter Schildmann <peter.schildmann@web.de>
for the driver for the Technisat SkyStar2 PCI DVB card

Vadim Catana <skystar@moldova.cc>
Roberto Ragusa <r.ragusa@libero.it>
Augusto Cardoso <augusto@carhil.net>
for all the work for the FlexCopII chipset by B2C2,Inc.

Davor Emard <emard@softhome.net>
for his work on the budget drivers, the demux code,
the module unloading problems, ...

Hans-Frieder Vogt <hfvogt@arcor.de>
for his work on calculating and checking the crc's for the
TechnoTrend/Hauppauge DEC driver firmware

Michael Dreher <michael@5dot1.de>
Andreas 'randy' Weinberger
for the support of the Fujitsu-Siemens Activy budget DVB-S

Kenneth Aafly <ke-aa@frisurf.no>

for adding support for Typhoon DVB-S budget card

Ernst Peinlich <e.peinlich@inode.at>
for tuning/DiSEqC support for the DEC 3000-s

Peter Beutner <p.beutner@gmx.net>
for the IR code for the ttusb-dec driver

Wilson Michaels <wilsonmichaels@earthlink.net>
for the lgdt330x frontend driver, and various bugfixes

Michael Krufky <mkrufky@linuxtv.org>
for maintaining v4l/dvb inter-tree dependencies

Taylor Jacob <rtjacob@earthlink.net>
for the nxt2002 frontend driver

Jean-Francois Thibert <jeanfrancois@sagetv.com>
for the nxt2004 frontend driver

Kirk Lapray <kirk.lapray@gmail.com>
for the or51211 and or51132 frontend drivers, and
for merging the nxt2002 and nxt2004 modules into a
single nxt200x frontend driver.

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- c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the program's name and a brief idea of what it does.>  
Copyright (C) <year> <name of author>
```

```
This program is free software; you can redistribute it and/or modify  
it under the terms of the GNU General Public License as published by  
the Free Software Foundation; either version 2 of the License, or  
(at your option) any later version.
```

```
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```

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```

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

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

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

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

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

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c) accompany it with the information you received as to where the corresponding source code may be obtained. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form alone.)

Source code for a work means the preferred form of the work for making modifications to it. For an executable file, complete source code means all the source code for all modules it contains; but, as a special exception, it need not include source code for modules which are standard libraries that accompany the operating system on which the executable file runs, or for standard header files or definitions files that accompany that operating system.

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Appendix: How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to humanity, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

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

```
This program is free software; you can redistribute it and/or modify  
it under the terms of the GNU General Public License as published by  
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any later version.
```

```
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```

```
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```

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

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

```
Gnomovision version 69, Copyright (C) 19xx name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

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

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the
program `Gnomovision' (a program to direct compilers to make passes
at assemblers) written by James Hacker.
```

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

That's all there is to it!

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Version 3, 29 June 2007

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1.56 cryptsetup 2.1.0

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1.59 cglib 3.3.0

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1.60 spring-data-commons 2.3.3.RELEASE

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1.61 bolt 1.2.1

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1.62 reactor-netty 0.9.11.RELEASE

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1.63 json-c 0.12.1

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1.64 gettext 0.16.1

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```

<signature of Ty Coon>, 1 April 1989

Ty Coon, President of Vice

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1.65 expat 2.2.0

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1.66 react-day-picker 7.4.8

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1.67 urllib3 1.25.3

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Contributions to the urllib3 project

Creator & Maintainer

* Andrey Petrov <andrey.petrov@shazow.net>

Contributors

In chronological order:

- * victor.vde <<http://code.google.com/u/victor.vde/>>
- * HTTPS patch (which inspired HTTPSConnectionPool)

- * erikcederstrand <<http://code.google.com/u/erikcederstrand/>>
- * NTLM-authenticated HTTPSConnectionPool
- * Basic-authenticated HTTPSConnectionPool (merged into make_headers)

- * niphlod <niphlod@gmail.com>
- * Client-verified SSL certificates for HTTPSConnectionPool
- * Response gzip and deflate encoding support
- * Better unicode support for filepost using StringIO buffers

- * btoconnor <brian@btoconnor.net>
- * Non-multipart encoding for POST requests

- * p.dobrogost <<http://code.google.com/u/@WBRSRIBZDhBFXQB6/>>
- * Code review, PEP8 compliance, benchmark fix

- * kennethreitz <me@kennethreitz.com>
- * Bugfixes, suggestions, Requests integration

- * georgemarshall <<https://github.com/georgemarshall>>
- * Bugfixes, Improvements and Test coverage

- * Thomas Kluyver <thomas@kluyver.me.uk>
- * Python 3 support

- * brandon-rhodes <<http://rhodesmill.org/brandon>>
- * Design review, bugfixes, test coverage.

- * studer <theo.studer@gmail.com>
- * IPv6 url support and test coverage

- * Shivaram Lingamneni <slingamn@cs.stanford.edu>
- * Support for explicitly closing pooled connections

- * hartator <hartator@gmail.com>
- * Corrected multipart behavior for params

- * Thomas Weischuh <thomas@t-8ch.de>
- * Support for TLS SNI
- * API unification of ssl_version/cert_reqs
- * SSL fingerprint and alternative hostname verification
- * Bugfixes in testsuite

- * Sune Kirkeby <mig@ibofobi.dk>
- * Optional SNI-support for Python 2 via PyOpenSSL.

- * Marc Schlaich <marc.schlaich@gmail.com>
 - * Various bugfixes and test improvements.

- * Bryce Boe <bbzbryce@gmail.com>
 - * Correct six.moves conflict
 - * Fixed pickle support of some exceptions

- * Boris Figovsky <boris.figovsky@ravellosystems.com>
 - * Allowed to skip SSL hostname verification

- * Cory Benfield <<https://lukasa.co.uk/about/>>
 - * Stream method for Response objects.
 - * Return native strings in header values.
 - * Generate 'Host' header when using proxies.

- * Jason Robinson <jaywink@basshero.org>
 - * Add missing WrappedSocket.fileno method in PyOpenSSL

- * Audrius Butkevicius <audrius.butkevicius@elastichosts.com>
 - * Fixed a race condition

- * Stanislav Vitkovskiy <stas.vitkovsky@gmail.com>
 - * Added HTTPS (CONNECT) proxy support

- * Stephen Holsapple <sholsapp@gmail.com>
 - * Added abstraction for granular control of request fields

- * Martin von Gagern <Martin.vGagern@gmx.net>
 - * Support for non-ASCII header parameters

- * Kevin Burke <kev@inburke.com> and Pavel Kirichenko <juanych@yandex-team.ru>
 - * Support for separate connect and request timeouts

- * Peter Waller <p@pwaller.net>
 - * HTTPResponse.tell() for determining amount received over the wire

- * Nipunn Koorapati <nipunn1313@gmail.com>
 - * Ignore default ports when comparing hosts for equality

- * Danilo @dbrgn <<https://dbrgn.ch/>>
 - * Disabled TLS compression by default on Python 3.2+
 - * Disabled TLS compression in pyopenssl contrib module
 - * Configurable cipher suites in pyopenssl contrib module

- * Roman Bogorodskiy <roman.bogorodskiy@ericsson.com>
 - * Account retries on proxy errors

- * Nicolas Delaby <nicolas.delaby@ezeep.com>
- * Use the platform-specific CA certificate locations

- * Josh Schneier <https://github.com/jschneier>
- * HTTPHeaderDict and associated tests and docs
- * Bugfixes, docs, test coverage

- * Tahia Khan <http://tahia.tk/>
- * Added Timeout examples in docs

- * Arthur Grunseid <https://grunseid.com>
- * source_address support and tests (with https://github.com/bui)

- * Ian Cordasco <graffatcolmingov@gmail.com>
- * PEP8 Compliance and Linting
- * Add ability to pass socket options to an HTTP Connection

- * Erik Tollerud <erik.tollerud@gmail.com>
- * Support for standard library io module.

- * Krishna Prasad <kprasad.iitd@gmail.com>
- * Google App Engine documentation

- * Aaron Meurer <asmeurer@gmail.com>
- * Added Url.url, which unparses a Url

- * Evgeny Kapun <abacabadabacaba@gmail.com>
- * Bugfixes

- * Benjamin Meyer <bm_witness@yahoo.com>
- * Security Warning Documentation update for proper capture

- * Shivan Sornarajah <github@sornars.com>
- * Support for using ConnectionPool and PoolManager as context managers.

- * Alex Gaynor <alex.gaynor@gmail.com>
- * Updates to the default SSL configuration

- * Tomas Tomecek <ttomecek@redhat.com>
- * Implemented generator for getting chunks from chunked responses.

- * tlynn <https://github.com/tlynn>
- * Respect the warning preferences at import.

- * David D. Riddle <ddriddle@illinois.edu>
- * IPv6 bugfixes in testsuite

- * Thea Flowers <magicalgirl@google.com>

- * App Engine environment tests.
- * Documentation re-write.

- * John Krauss <<https://github.com/talos>>
- * Clues to debugging problems with `cryptography` dependency in docs

- * Disassem <<https://github.com/Disassem>>
- * Fix pool-default headers not applying for url-encoded requests like GET.

- * James Atherfold <jlatherfold@hotmail.com>
- * Bugfixes relating to cleanup of connections during errors.

- * Christian Pedersen <<https://github.com/chripede>>
- * IPv6 HTTPS proxy bugfix

- * Jordan Moldow <<https://github.com/jmoldow>>
- * Fix low-level exceptions leaking from ``HTTPResponse.stream()``.
- * Bugfix for ``ConnectionPool.urlopen(release_conn=False)``.
- * Creation of ``HTTPConnectionPool.ResponseCls``.

- * Predrag Gruevski <<https://github.com/obi1kenobi>>
- * Made cert digest comparison use a constant-time algorithm.

- * Adam Talsma <<https://github.com/a-tal>>
- * Bugfix to ca_cert file paths.

- * Evan Meagher <<https://evanmeagher.net>>
- * Bugfix related to `memoryview` usage in PyOpenSSL adapter

- * John Vandenberg <jayvdb@gmail.com>
- * Python 2.6 fixes; pyflakes and pep8 compliance

- * Andy Caldwell <andy.m.caldwell@gmail.com>
- * Bugfix related to reusing connections in indeterminate states.

- * Ville Skytt <ville.skytta@iki.fi>
- * Logging efficiency improvements, spelling fixes, Travis config.

- * Shige Takeda <smtakeda@gmail.com>
- * Started Recipes documentation and added a recipe about handling concatenated gzip data in HTTP response

- * Jess Shapiro <jesse@jesseshapiro.net>
- * Various character-encoding fixes/tweaks
- * Disabling IPv6 DNS when IPv6 connections not supported

- * David Foster <<http://dafoster.net/>>
- * Ensure order of request and response headers are preserved.

- * Jeremy Cline <jeremy@jcline.org>
- * Added connection pool keys by scheme

- * Aviv Palivoda <palaviv@gmail.com>
- * History list to Retry object.
- * HTTPResponse contains the last Retry object.

- * Nate Prewitt <nate.prewitt@gmail.com>
- * Ensure timeouts are not booleans and greater than zero.
- * Fixed infinite loop in ``stream`` when amt=None.
- * Added length_remaining to determine remaining data to be read.
- * Added enforce_content_length to raise exception when incorrect content-length received.

- * Seth Michael Larson <sethmichaellarson@protonmail.com>
- * Created selectors backport that supports PEP 475.

- * Alexandre Dias <alex.dias@smarkets.com>
- * Don't retry on timeout if method not in whitelist

- * Moinuddin Quadri <moin18@gmail.com>
- * Lazily load idna package

- * Tom White <s6yg1ez3@mail2tor.com>
- * Made SOCKS handler differentiate socks5h from socks5 and socks4a from socks4.

- * Tim Burke <tim.burke@gmail.com>
- * Stop buffering entire deflate-encoded responses.

- * Tuukka Mustonen <tuukka.mustonen@gmail.com>
- * Add counter for status_forcelist retries.

- * Erik Rose <erik@mozilla.com>
- * Bugfix to pyopenssl vendoring

- * Wolfgang Richter <wolfgang.richter@gmail.com>
- * Bugfix related to loading full certificate chains with PyOpenSSL backend.

- * Mike Miller <github@mikeage.net>
- * Logging improvements to include the HTTP(S) port when opening a new connection

- * Ioannis Tziakos <mail@itziakos.gr>
- * Fix ``util.selectors._fileobj_to_fd`` to accept ``long``.
- * Update appveyor tox setup to use the 64bit python.

- * Akamai (through Jess Shapiro) <jshapiro@akamai.com>
- * Ongoing maintenance; 2017-2018

- * Dominique Leuenberger <dimstar@opensuse.org>

- * Minor fixes in the test suite
- * Will Bond <will@wbond.net>
- * Add Python 2.6 support to ``contrib.securetransport``
- * Aleksei Alekseev <alekseev.yeskela@gmail.com>
- * using auth info for socks proxy
- * Chris Wilcox <git@crwilcox.com>
- * Improve contribution guide
- * Add ``HTTPResponse.geturl`` method to provide ``urllib2.urlopen().geturl()`` behavior
- * Bruce Merry <https://www.brucemerry.org.za>
- * Fix leaking exceptions when system calls are interrupted with zero timeout
- * Hugo van Kemenade <https://github.com/hugovk>
- * Drop support for EOL Python 2.6
- * Tim Bell <https://github.com/timb07>
- * Bugfix for responses with Content-Type: message/* logging warnings
- * Justin Bramley <https://github.com/jbramleycl>
- * Add ability to handle multiple Content-Encodings
- * Katsuhiko YOSHIDA <https://github.com/kyoshidajp>
- * Remove Authorization header regardless of case when redirecting to cross-site
- * [Your name or handle] <[email or website]>
- * [Brief summary of your changes]

1.68 luafilesystem 1.5.0

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LuaFileSystem - File System Library for Lua

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<http://www.keplerproject.org/luafilename>

Description

LuaFileSystem is a Lua library developed to complement the set of functions related to file systems offered by the standard Lua distribution.

LuaFileSystem offers a portable way to access the underlying directory structure and file attributes.

LuaFileSystem is free software and uses the same license as Lua 5.1

LuaRocks Installation

luarocks install luafilename

Documentation

Please check the documentation at doc/us/ for more information.

History

Version 1.5.0 [20/Oct/2009]

* added explicit next and close methods to second return value of lfs.dir (the directory object), for explicit iteration or explicit closing.

* added directory locking via lfs.lock_dir function (see the manual).

Version 1.4.2 [03/Feb/2009]

* fixed bug [#13198] lfs.attributes(filename, 'size') overflow on files > 2 Gb again (bug report and patch by KUBO Takehiro).

* fixed bug [#39794] Compile error on Solaris 10 (bug report and patch by Aaron B).

* fixed compilation problems with Borland C.

Version 1.4.1 [07/May/2008]

* documentation review

- * fixed Windows compilation issues
- * fixed bug in the Windows tests (patch by Shmuel Zeigerman)
- * fixed bug [#2185] lfs.attributes(filename, 'size') overflow on files > 2 Gb

Version 1.4.0 [13/Feb/2008]

- * added function lfs.setmode (works only in Windows systems).
- * lfs.attributes raises an error if attribute does not exist

Version 1.3.0 [26/Oct/2007]

- * added function lfs.symlinkattributes (works only in non Windows systems).

Version 1.2.1 [08/May/2007]

- * compatible only with Lua 5.1 (Lua 5.0 support was dropped)

Version 1.2 [15/Mar/2006]

- * added optional argument to lfs.attributes
- * added function lfs.rmdir
- * bug correction on lfs.dir

Version 1.1 [30/May/2005]

- * added function lfs.touch.

Version 1.0 [21/Jan/2005]

Version 1.0 Beta [10/Nov/2004]

Found in path(s):

* /opt/cola/permits/1547565634_1675069559.2011814/0/lunarmodules-luafilesystem-v1-5-0-0-g8ff2013-tar-gz/lunarmodules-luafilesystem-8ff2013/README

1.69 pam 1.3.1 Subuntu4.3

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Patch for Ubuntu bug #399071

Display the contents of /etc/legal as part of the MOTD, the first time the user logs in, and set a flag in the user's homedir if possible to prevent repeat displays.

Authors: Dustin Kirkland <kirkland@canonical.com>

Upstream status: Ubuntu-specific, maybe submit to Debian

Index: pam/modules/pam_motd/pam_motd.c

```
=====
--- pam.orig/modules/pam_motd/pam_motd.c
+++ pam/modules/pam_motd/pam_motd.c
@@ -97,6 +97,65 @@
 }
 }
```

```
+int display_legal(pam_handle_t *pamh)
+{
+ int retval = PAM_IGNORE, rc;
+ char *user = NULL;
+ char *dir = NULL;
+ char *flag = NULL;
+ struct passwd *pwd = NULL;
```

```

+ struct stat s;
+ int f;
+ /* Get the user name to determine if we need to print the disclaimer */
+ rc = pam_get_item(pamh, PAM_USER, &user);
+ if (rc == PAM_SUCCESS && user != NULL && *(const char *)user != '\0')
+ {
+     PAM_MODUTIL_DEF_PRIVS(privs);
+
+     /* Get the password entry */
+     pwd = pam_modutil_getpwnam (pamh, user);
+     if (pwd != NULL)
+     {
+         if (pam_modutil_drop_priv(pamh, &privs, pwd)) {
+             pam_syslog(pamh, LOG_ERR,
+                 "Unable to change UID to %d temporarily\n",
+                 pwd->pw_uid);
+             retval = PAM_SESSION_ERR;
+             goto finished;
+         }
+
+         if (asprintf(&dir, "%s/.cache", pwd->pw_dir) == -1 || !dir)
+             goto finished;
+         if (asprintf(&flag, "%s/motd.legal-displayed", dir) == -1 || !flag)
+             goto finished;
+
+         if (stat(flag, &s) != 0)
+         {
+             int fd = open("/etc/legal", O_RDONLY, 0);
+             if (fd >= 0) {
+                 try_to_display_fd(pamh, fd);
+                 close(fd);
+             }
+             mkdir(dir, 0700);
+             f = open(flag, O_WRONLY|O_CREAT|O_EXCL,
+                 S_IRUSR|S_IWUSR|S_IRGRP|S_IROTH);
+             if (f>=0) close(f);
+         }
+
+     +finished:
+         if (pam_modutil_regain_priv(pamh, &privs)) {
+             pam_syslog(pamh, LOG_ERR,
+                 "Unable to change UID back to %d\n", privs.old_uid);
+             retval = PAM_SESSION_ERR;
+         }
+
+         _pam_drop(flag);
+         _pam_drop(dir);
+     }

```



```

+ }
+ return retval;
+}
+
int pam_sm_open_session(pam_handle_t *pamh, int flags,
    int argc, const char **argv)
{
@@ -170,6 +229,9 @@
    if (motd_dir_path != NULL)
try_to_display_directory(pamh, motd_dir_path);

+ /* Display the legal disclaimer only if necessary */
+ retval = display_legal(pamh);
+
    return retval;
}

```

This package was debianized by J.H.M. Dassen (Ray) jdassen@debian.org on Wed, 23 Sep 1998 20:29:32 +0200.

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1.70 docker-engine 19.03.5

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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libacl/*.c

libacl/*.h

libmisc/*.c

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*/

/* checkTag : validation tool for libzstd

* command :

* \$./checkTag tag

* checkTag validates tags of following format : v[0-9].[0-9].[0-9]{any}

* The tag is then compared to zstd version number.

* They are compatible if first 3 digits are identical.

* Anything beyond that is free, and doesn't impact validation.

* Example : tag v1.8.1.2 is compatible with version 1.8.1

* When tag and version are not compatible, program exits with error code 1.

* When they are compatible, it exists with a code 0.

* checkTag is intended to be used in automated testing environment.

*/

1.75 stunel 5.56

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The original code is FirewallControl.pas, released April 16, 2007.

The initial developer of the original code is Rainer Budde (<http://www.speed-soft.de>).

SimpleFC - NSIS Firewall Plugin is written, published and maintained by
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1.76 swagger 2.1.9

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jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java

1.77 springdoc-openapi-common 1.5.9

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1.78 x-crypto 0.0.0-20200302210943-78000ba7a073

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1.82 ipmi-tool 1.8.18

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1.83 boost 1.67.0

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/*

* hash.c: chained hash tables

*

* Reference: Your favorite introductory book on algorithms

*

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1.85 libxml2 2.9.10+dfsg-5ubuntu0.20.04.5

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1.86 curl 7.50.1

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1.87 swagger-models 2.1.9

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 */
```

Found in path(s):

```
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/security/Scopes.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/ByteArraySchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/security/OAuthFlows.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/Paths.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/ComposedSchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
```

jar/io/swagger/v3/oas/models/media/DateTimeSchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/tags/Tag.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/EncodingProperty.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/parameters/CookieParameter.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/security/SecurityScheme.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/servers/ServerVariable.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/Content.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/examples/Example.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/security/OAuthFlow.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/StringSchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/Operation.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/UUIDSchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/info/License.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/XML.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/info/Info.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/DateSchema.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/media/MediaType.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/servers/ServerVariables.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/parameters/PathParameter.java
* /opt/cola/permits/1165124349_1620941204.65/0/swagger-models-2-1-9-sources-
jar/io/swagger/v3/oas/models/info/Contact.java
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1.88 procps 3.2.8

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Email domain: cam.ac.uk

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Email domain: cam.ac.uk

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END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Programs

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

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

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```
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Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.  
This is free software, and you are welcome to redistribute it  
under certain conditions; type `show c' for details.
```

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

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

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

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

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1.92 flyway-core 7.3.1

1.92.1 Available under license :

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Found in path(s):

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/META-INF/maven/org.flywaydb/flyway-core/pom.xml

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/VersionPrinter.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/command/DbRepair.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/InsertRowLock.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PlaceholderReplacingReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/clazz/NoopClassProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/MigrateResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/SchemaObject.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcNullTypes.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/strategy/BackoffStrategy.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabaseType.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/Locations.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutorFactory.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/ResourceNameCache.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleParser.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabaseType.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/jboss/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/DatabaseType.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/InformixDatabase.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/LogFactory.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlStatement.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/DateUtils.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/log4j2/Log4j2Log.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabase.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Table.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/BaselineResult.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PositionTrackingReader.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/ClasspathClassScanner.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/Location.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleSchema.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Warning.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/package-info.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/SimpleContext.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/OperationResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASETTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/ConfigUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/WarningImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Connection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLConnection.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/Recorder.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ErrorOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/android/ContextHolder.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ValidateOutput.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/filesystem/FileSystemScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ValidateResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/ExternalAuthPropertiesProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/SqlScriptCallbackFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/ParsingContext.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2DatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/configuration/Configuration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/AsciiTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/ExecutionTemplateFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/sql/package-info.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEJConnectDatabaseType.java

* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Type.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptMetadata.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/ExternalAuthFileReader.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLTable.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/classpath/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/FlywayException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Context.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/JavaMigration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/RepairResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabase.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/schemahistory/SchemaHistory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/InformixTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/exception/FlywayValidateException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftSchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/ParserSqlScript.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/resolver/ChecksumMatcher.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/BomFilter.java
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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jar/org/flywaydb/core/internal/jdbc/RowMapper.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/ResourceNameValidator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/executor/MigrationExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/util/StringUtils.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/android/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/oracle/OracleDatabaseType.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-jar/org/flywaydb/core/package-
info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/filesystem/FileSystemResource.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/ClassProvider.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/ResolvedMigrationComparator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutor.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/h2/H2Parser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/cloud/gcs/GCSScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/LocationScannerCache.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/info/MigrationInfoImpl.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-

jar/org/flywaydb/core/internal/sqlscript/FlywaySqlScriptException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/mysql/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/derby/DerbySchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
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* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/android/AndroidScanner.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/schemahistory/AppliedMigration.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/exception/FlywaySqlException.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/jdbc/ExecutionTemplate.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/sqlscript/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/command/DbSchemas.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/UnboundedReadAheadReader.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/CompositeResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/informix/InformixParser.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/saphana/SAPHANASchema.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/command/DbInfo.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/MigrationVersion.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/base/Table.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resolver/MigrationInfoHelper.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/parser/Token.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/api/output/UndoResult.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/logging/log4j2/Log4j2LogCreator.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/redshift/RedshiftTable.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/resource/android/package-info.java
* /opt/cola/permits/1129909879_1612394249.98/0/flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBSchema.java

1.93 swagger-annotations 2.1.9

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```

Found in path(s):

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* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/servers/Servers.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/media/Encoding.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/callbacks/Callback.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/SecuritySchemes.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/info/Info.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/SecurityRequirement.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/SecurityScheme.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/callbacks/Callbacks.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/headers/Header.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/info/Contact.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/tags/Tag.java
* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-
jar/io/swagger/v3/oas/annotations/security/OAuthFlow.java
```

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Operation.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Parameter.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/servers/Server.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Parameters.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/OAuthFlows.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/OAuthScope.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/extensions/Extensions.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/ExampleObject.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/info/License.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/OpenAPIDefinition.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/Schema.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/tags/Tags.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/SecurityRequirements.java

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* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/responses/ApiResponse.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/ExternalDocumentation.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/DiscriminatorMapping.java

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* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/links/LinkParameter.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Hidden.java

* /opt/cola/permits/1165124384_1620941199.55/0/swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/Content.java

1.94 ntp 4.2.8p15

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The following individuals contributed in part to the Network Time Protocol Distribution Version 4 and are acknowledged as authors of this work.

1. [1]Takao Abe <takao_abe@xurb.jp> Clock driver for JJY receivers
2. [2]Mark Andrews <mark_andrews@isc.org> Leitch atomic clock controller
3. [3]Bernd Altmeier <altmeier@atlsoft.de> hopf Elektronik serial line and PCI-bus devices
4. [4]Viraj Bais <vbais@mailman1.intel.com> and [5]Clayton Kirkwood <kirkwood@striderfm.intel.com> port to WindowsNT 3.5
5. [6]Michael Barone <michael,barone@lmco.com> GPSVME fixes
6. [7]Karl Berry <karl@owl.HQ.ileaf.com> syslog to file option
7. [8]Greg Brackley <greg.brackley@bigfoot.com> Major rework of WINNT port. Clean up recvbuf and iosignal code into separate modules.
8. [9]Marc Brett <Marc.Brett@westgeo.com> Magnavox GPS clock driver
9. [10]Piete Brooks <Piete.Brooks@cl.cam.ac.uk> MSF clock driver, Trimble PARSE support
10. [11]Nelson B Bolyard <nelson@bolyard.me> update and complete broadcast and crypto features in sntp
11. [12]Jean-Francois Boudreault <Jean-Francois.Boudreault@viagenie.qc.ca> IPv6 support
12. [13]Reg Clemens <reg@dwf.com> Oncore driver (Current maintainer)
13. [14]Steve Clift <clift@ml.csiro.au> OMEGA clock driver
14. [15]Casey Crellin <casey@csc.co.za> vxWorks (Tornado) port and help with target configuration
15. [16]Sven Dietrich <sven_dietrich@trimble.com> Palisade reference clock driver, NT adj. residuals, integrated Greg's Winnt port.
16. [17]John A. Dundas III <dundas@salt.jpl.nasa.gov> Apple A/UX port
17. [18]Torsten Duwe <duwe@immd4.informatik.uni-erlangen.de> Linux port
18. [19]Dennis Ferguson <dennis@mrbill.canet.ca> foundation code for

NTP Version 2 as specified in RFC-1119

19. [20]John Hay <jhay@icomtek.csir.co.za> IPv6 support and testing
20. [21]Dave Hart <davehart@davehart.com> General maintenance, Windows port interpolation rewrite
21. [22]Claas Hilbrecht <neoclock4x@linum.com> NeoClock4X clock driver
22. [23]Glenn Hollinger <glenn@herald.usask.ca> GOES clock driver
23. [24]Mike Iglesias <iglesias@uci.edu> DEC Alpha port
24. [25]Jim Jagielski <jim@jagubox.gsfc.nasa.gov> A/UX port
25. [26]Jeff Johnson <jbj@chatham.usdesign.com> massive prototyping overhaul
26. [27]Hans Lambermont <Hans.Lambermont@nl.origin-it.com> or [28]<H.Lambermont@chello.nl> ntpsweep
27. [29]Poul-Henning Kamp <phk@FreeBSD.ORG> Oncore driver (Original author)
28. [30]Frank Kardel [31]<kardel (at) ntp (dot) org> PARSE <GENERIC> (driver 14 reference clocks), STREAMS modules for PARSE, support scripts, syslog cleanup, dynamic interface handling
29. [32]Johannes Maximilian Kuehn <kuehn@ntp.org> Rewrote sntp to comply with NTPv4 specification, ntpq saveconfig
30. [33]William L. Jones <jones@hermes.chpc.utexas.edu> RS/6000 AIX modifications, HPUX modifications
31. [34]Dave Katz <dkatz@cisco.com> RS/6000 AIX port
32. [35]Craig Leres <leres@ee.lbl.gov> 4.4BSD port, ppsclock, Magnavox GPS clock driver
33. [36]George Lindholm <lindholm@ucs.ubc.ca> SunOS 5.1 port
34. [37]Louis A. Mamakos <louie@ni.umd.edu> MD5-based authentication
35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation code for Version 3 as specified in RFC-1305
36. [39]Danny Mayer <mayer@ntp.org>Network I/O, Windows Port, Code Maintenance
37. [40]David L. Mills <mills@udel.edu> Version 4 foundation, precision kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36
38. [41]Wolfgang Moeller <moeller@gwdgv1.dnet.gwdg.de> VMS port
39. [42]Jeffrey Mogul <mogul@pa.dec.com> ntptrace utility
40. [43]Tom Moore <tmoores@fivel.daytonoh.ncr.com> i386 svr4 port
41. [44]Kamal A Mostafa <kamal@whence.com> SCO OpenServer port
42. [45]Derek Mulcahy <derek@toybox.demon.co.uk> and [46]Damon Hart-Davis <d@hd.org> ARCRON MSF clock driver
43. [47]Rob Neal <neal@ntp.org> Bancomm refclock and config/parse code maintenance
44. [48]Rainer Pruy <Rainer.Pruy@informatik.uni-erlangen.de> monitoring/trap scripts, statistics file handling
45. [49]Dirce Richards <dirce@zk3.dec.com> Digital UNIX V4.0 port
46. [50]Wilfredo Sanchez <wsanchez@apple.com> added support for NetInfo
47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
48. [52]Jack Sasportas <jack@innovativeinternet.com> Saved a Lot of space on the stuff in the html/pic/ subdirectory
49. [53]Ray Schnitzler <schnitz@unipress.com> Unixware1 port

50. [54]Michael Shields <shields@tembel.org> USNO clock driver
 51. [55]Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
 52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
 53. [57]Kenneth Stone <ken@sdd.hp.com> HP-UX port
 54. [58]Ajit Thyagarajan <ajit@ee.udel.edu>IP multicast/anycast support
 55. [59]Tomoaki TSURUOKA <tsuruoka@nc.fukuoka-u.ac.jp>TRAK clock driver
 56. [60]Brian Utterback <brian.utterback@oracle.com> General codebase, Solaris issues
 57. [61]Loganaden Velvindron <loganaden@gmail.com> Sandboxing (libseccomp) support
 58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic TrueTime clock driver
 59. [63]Ulrich Windl <Ulrich.Windl@rz.uni-regensburg.de> corrected and validated HTML documents according to the HTML DTD
-

References

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

30. <http://www4.informatik.uni-erlangen.de/%7ekardel>
31. <mailto:%20kardel%20%28at%29%20ntp%20%28dot%29%20org>
32. <mailto:kuehn@ntp.org>
33. <mailto:%20jones@hermes.chpc.utexas.edu>
34. <mailto:%20dkatz@cisco.com>
35. <mailto:%20leres@ee.lbl.gov>
36. <mailto:%20lindholm@ucs.ubc.ca>
37. <mailto:%20louie@ni.umd.edu>
38. <mailto:%20thorinn@diku.dk>
39. <mailto:%20mayer@ntp.org>
40. <mailto:%20mills@udel.edu>
41. <mailto:%20moeller@gwdgv1.dnet.gwdg.de>
42. <mailto:%20mogul@pa.dec.com>
43. <mailto:%20tmoore@fielvel.daytonoh.ncr.com>
44. <mailto:%20kamal@whence.com>
45. <mailto:%20derek@toybox.demon.co.uk>
46. <mailto:%20d@hd.org>
47. <mailto:%20neal@ntp.org>
48. <mailto:%20Rainer.Pruy@informatik.uni-erlangen.de>
49. <mailto:%20dirce@zk3.dec.com>
50. <mailto:%20wsanchez@apple.com>
51. <mailto:%20mrapple@quack.kfu.com>
52. <mailto:%20jack@innovativeinternet.com>
53. <mailto:%20schnittz@unipress.com>
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55. <mailto:%20pebbles.jpl.nasa.gov>
56. <mailto:%20harlan@pfcs.com>
57. <mailto:%20ken@sdd.hp.com>
58. <mailto:%20ajit@ee.udel.edu>
59. <mailto:%20tsuruoka@nc.fukuoka-u.ac.jp>
60. <mailto:%20brian.utterback@oracle.com>
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62. <mailto:%20vixie@vix.com>
63. <mailto:%20Ulrich.Windl@rz.uni-regensburg.de>

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Version 3, 29 June 2007

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- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit5/annotation/FlywayTestExtension.java
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit5/FlywayTestExtension.java
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit/FlywayTestExecutionListener.java
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/ExecutionListenerHelper.java
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit/FlywayHelperFactory.java
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit5/annotation/package-info.java
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- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/FlywayTestExecutionListener.java
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/FlywayHelperFactory.java

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- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/context/dataSourceSingleContext.xml
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/context/simple_applicationContext.xml
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-jar/context/flywayContainerContext.xml
- * /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-

```
jar/context/flywaySingleContext.xml
* /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-
jar/context/secondFlywayContainerContext.xml
* /opt/cola/permits/1129909886_1612394261.4/0/flyway-spring5-test-6-4-0-sources-
jar/context/flywayPropertiesContext.xml
```

1.98 xmltooling 3.0.5-1build1

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1.101 libiconv 1.14

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```

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GNU LIBICONV - character set conversion library

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

It provides support for the encodings:

European languages

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

Semitic languages

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

Japanese

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

Chinese

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

Korean

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

Armenian

ARMSCII-8

Georgian

Georgian-Academy, Georgian-PS

Tajik

KOI8-T
Kazakh
PT154, RK1048
Thai
ISO-8859-11, TIS-620, CP874, MacThai
Laotian
MuleLao-1, CP1133
Vietnamese
VISCII, TCVN, CP1258
Platform specifics
HP-ROMAN8, NEXTSTEP
Full Unicode
UTF-8
UCS-2, UCS-2BE, UCS-2LE
UCS-4, UCS-4BE, UCS-4LE
UTF-16, UTF-16BE, UTF-16LE
UTF-32, UTF-32BE, UTF-32LE
UTF-7
C99, JAVA
Full Unicode, in terms of 'uint16_t' or 'uint32_t'
(with machine dependent endianness and alignment)
UCS-2-INTERNAL, UCS-4-INTERNAL
Locale dependent, in terms of 'char' or 'wchar_t'
(with machine dependent endianness and alignment, and with OS and
locale dependent semantics)
char, wchar_t
The empty encoding name "" is equivalent to "char": it denotes the
locale dependent character encoding.

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

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

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

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

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

Installation

As usual for GNU packages:

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

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

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

- first `libiconv`, then `gettext`, then `libiconv` again,

or (on systems supporting shared libraries, excluding AIX)

- first `gettext`, then `libiconv`, then `gettext` again.

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

This library can be built and installed in two variants:

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

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

To use it in an autoconfiguring package:

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

these additions are the *_LDADD variables.

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

- The libc plug/override mode. This works on GNU/Linux, Solaris and OSF/1 systems only. It is a way to get good iconv support without having glibc-2.1.

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

On GNU/Linux and Solaris:

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

On OSF/1:

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

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

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The libiconv and libcharset _libraries_ and their header files are under LGPL, see file COPYING.LIB.

The iconv _program_ and the documentation are under GPL, see file COPYING.

Download

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

Homepage

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

Bug reports to

<bug-gnu-libiconv@gnu.org>

Bruno Haible <bruno@clisp.org>

1.102 acpid 2.0.11

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```
<one line to give the program's name and a brief idea of what it does.>  
Copyright (C) 19yy <name of author>
```

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```
Gnomovision version 69, Copyright (C) 19yy name of author  
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.  
This is free software, and you are welcome to redistribute it  
under certain conditions; type `show c' for details.
```

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

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

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

Ty Coon, President of Vice

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1.103 jandex 2.1.3.Final

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 */
```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/ParameterizedType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/Utils.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/FieldInfoGenerator.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/MethodInfoGenerator.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/ThrowsTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/TypeParameterBoundTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/EmptyTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
```

jar/org/jboss/jandex/PositionBasedTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/TypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/AnnotationTargetFilterCollection.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/IndexWriterImpl.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/TypeParameterTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/VoidType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/IndexReaderImpl.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/ArrayType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/IndexWriterV2.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/ClassExtendsTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/MethodParameterTypeTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/MethodInternal.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/WildcardType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/GenericSignatureParser.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/TypeVariable.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/UnresolvedTypeVariable.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-
jar/org/jboss/jandex/IndexReaderV2.java

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- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/PackedDataOutputStream.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassInfo.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriter.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/DotName.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInternal.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInfo.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/NameTable.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/CompositeIndex.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriterV1.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexView.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/StrongInternPool.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Indexer.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JarIndexer.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JandexAntTask.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInfo.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassType.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderV1.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Result.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Index.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodParameterInfo.java
- * /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/UnsupportedVersion.java

* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationValue.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationTarget.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/PrimitiveType.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Main.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/PackedDataInputStream.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationInstance.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReader.java
* /opt/ws_local/PERMITS_SQL/1063930911_1593103343.43/0/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Type.java

1.104 pytest 4.6.3

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1.105 webrtc m44

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modules/audio_coding/codecs/g711/main/source/g711.h
modules/audio_coding/codecs/g722/main/source/g722_decode.c
modules/audio_coding/codecs/g722/main/source/g722_enc_dec.h
modules/audio_coding/codecs/g722/main/source/g722_encode.c
modules/audio_coding/codecs/isac/main/source/fft.c
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modules/audio_device/mac/portaudio/pa_ringbuffer.c
modules/audio_device/mac/portaudio/pa_ringbuffer.h
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system_wrappers/source/set_thread_name_win.h
system_wrappers/source/spreadsortlib/constants.hpp
system_wrappers/source/spreadsortlib/spreadsort.hpp

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common_audio/signal_processing/spl_sqrt_floor_arm.S

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/*

* Written by Wilco Dijkstra, 1996. The following email exchange establishes the

* license.
*
* From: Wilco Dijkstra <Wilco.Dijkstra@ntlworld.com>
* Date: Fri, Jun 24, 2011 at 3:20 AM
* Subject: Re: sqrt routine
* To: Kevin Ma <kma@google.com>
* Hi Kevin,
* Thanks for asking. Those routines are public domain (originally posted to
* comp.sys.arm a long time ago), so you can use them freely for any purpose.
* Cheers,
* Wilco

* ----- Original Message -----

* From: "Kevin Ma" <kma@google.com>
* To: <Wilco.Dijkstra@ntlworld.com>
* Sent: Thursday, June 23, 2011 11:44 PM
* Subject: Fwd: sqrt routine
* Hi Wilco,
* I saw your sqrt routine from several web sites, including
* <http://www.finesse.demon.co.uk/steven/sqrt.html>.
* Just wonder if there's any copyright information with your Successive
* approximation routines, or if I can freely use it for any purpose.
* Thanks.
* Kevin
*/

Files:

modules/audio_coding/codecs/g711/main/source/g711.c
modules/audio_coding/codecs/g711/main/source/g711.h

License:

/*
* SpanDSP - a series of DSP components for telephony
*
* g711.h - In line A-law and u-law conversion routines
*
* Written by Steve Underwood <steveu@coppice.org>
*
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modules/audio_coding/codecs/g722/main/source/g722_enc_dec.h
modules/audio_coding/codecs/g722/main/source/g722_encode.c

License:

/*

* SpanDSP - a series of DSP components for telephony
*
* g722_decode.c - The ITU G.722 codec, decode part.
*
* Written by Steve Underwood <steveu@coppice.org>
*
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*
* Based in part on a single channel G.722 codec which is:
*
* Copyright (c) CMU 1993
* Computer Science, Speech Group
* Chengxiang Lu and Alex Hauptmann
*/

Files:

modules/audio_coding/codecs/isac/main/source/fft.c

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Files:

modules/audio_device/mac/portaudio/pa_memorybarrier.h
modules/audio_device/mac/portaudio/pa_ringbuffer.c
modules/audio_device/mac/portaudio/pa_ringbuffer.h

License:

/*
* \$Id: pa_memorybarrier.h 1240 2007-07-17 13:05:07Z bjornroche \$
* Portable Audio I/O Library
* Memory barrier utilities
*
* Author: Bjorn Roche, XO Audio, LLC
*
* This program uses the PortAudio Portable Audio Library.
* For more information see: <http://www.portaudio.com>
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*/

/*

* \$Id: pa_ringbuffer.c 1421 2009-11-18 16:09:05Z bjornroche \$

* Portable Audio I/O Library

* Ring Buffer utility.

*

* Author: Phil Burk, <http://www.softsynth.com>

* modified for SMP safety on Mac OS X by Bjorn Roche

* modified for SMP safety on Linux by Leland Lucius

* also, allowed for const where possible

* modified for multiple-byte-sized data elements by Sven Fischer

*

* Note that this is safe only for a single-thread reader and a

* single-thread writer.

*

* This program uses the PortAudio Portable Audio Library.

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Files:

common_audio/fft4g.c
modules/audio_processing/aec/aec_rdfc.c

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system_wrappers/source/condition_variable_event_win.cc

Source:

<http://www1.cse.wustl.edu/~schmidt/ACE-copying.html>

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Files:

system_wrappers/source/set_thread_name_win.h

Source:

<http://msdn.microsoft.com/en-us/cc300389.aspx#P>

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Files:

system_wrappers/source/spreadsortlib/constants.hpp
system_wrappers/source/spreadsortlib/spreadsort.hpp

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1.106 jackson-annotations 2.11.2

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1.107 mongodb 5.0.6

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1.108 netty-transport 4.1.51.Final

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```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/oio/AbstractOioMessageChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/bootstrap/Bootstrap.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/MultithreadEventLoopGroup.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelInboundHandlerAdapter.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/local/LocalAddress.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/DefaultSocketChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/nio/AbstractNioMessageChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/oio/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelDuplexHandler.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
```

jar/io/netty/channel/socket/DefaultServerSocketChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/nio/NioDatagramChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/DatagramPacket.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultEventLoopGroup.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/Channel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/oio/AbstractOioChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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jar/io/netty/channel/ChannelFuture.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/local/LocalChannelRegistry.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/AdaptiveRecvByteBufAllocator.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/oio/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/RecvByteBufAllocator.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelFlushPromiseNotifier.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelPromiseAggregator.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/DatagramChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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jar/io/netty/channel/ChannelPipelineException.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/AbstractChannel.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/AbstractChannelHandlerContext.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/CompleteChannelFuture.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/DefaultChannelPromise.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/ServerSocketChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/local/LocalEventLoopGroup.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/socket/DatagramChannelConfig.java

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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/DefaultOioDatagramChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DelegatingChannelPromiseNotifier.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/FailedChannel.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelOutputShutdownEvent.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/internal/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/SelectedSelectionKeySetSelector.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioDatagramChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelInputShutdownReadComplete.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/internal/ChannelUtils.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelOutputShutdownException.java
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jar/io/netty/channel/EventLoopTaskQueueFactory.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelHandlerMask.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
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/**

* Handles an I/O event or intercepts an I/O operation, and forwards it to its next handler in
* its { @link ChannelPipeline }.

*

* <h3>Sub-types</h3>

* <p>

* { @link ChannelHandler } itself does not provide many methods, but you usually have to implement one of its
subtypes:

*

* { @link ChannelInboundHandler } to handle inbound I/O events, and

* { @link ChannelOutboundHandler } to handle outbound I/O operations.

*

* </p>

* <p>

* Alternatively, the following adapter classes are provided for your convenience:

*

* { @link ChannelInboundHandlerAdapter } to handle inbound I/O events,

* { @link ChannelOutboundHandlerAdapter } to handle outbound I/O operations, and

* { @link ChannelDuplexHandler } to handle both inbound and outbound events

*

* </p>

* <p>

* For more information, please refer to the documentation of each subtype.

* </p>

*

* <h3>The context object</h3>

```

* <p>
* A {@link ChannelHandler} is provided with a {@link ChannelHandlerContext}
* object. A {@link ChannelHandler} is supposed to interact with the
* {@link ChannelPipeline} it belongs to via a context object. Using the
* context object, the {@link ChannelHandler} can pass events upstream or
* downstream, modify the pipeline dynamically, or store the information
* (using {@link AttributeKey}s) which is specific to the handler.
*
* <h3>State management</h3>
*
* A {@link ChannelHandler} often needs to store some stateful information.
* The simplest and recommended approach is to use member variables:
* <pre>
* public interface Message {
*     // your methods here
* }
*
* public class DataServerHandler extends {@link SimpleChannelInboundHandler}&lt;Message&gt; {
*
*     <b>private boolean loggedIn;</b>
*
*     {@code @Override}
*     public void channelRead0({@link ChannelHandlerContext} ctx, Message message) {
*         if (message instanceof LoginMessage) {
*             authenticate((LoginMessage) message);
*             <b>loggedIn = true;</b>
*         } else (message instanceof GetDataMessage) {
*             if (<b>loggedIn</b>) {
*                 ctx.writeAndFlush(fetchSecret((GetDataMessage) message));
*             } else {
*                 fail();
*             }
*         }
*     }
*     ...
* }
* </pre>
*
* Because the handler instance has a state variable which is dedicated to
* one connection, you have to create a new handler instance for each new
* channel to avoid a race condition where a unauthenticated client can get
* the confidential information:
* <pre>
* // Create a new handler instance per channel.
* // See {@link ChannelInitializer#initChannel(Channel)}.
* public class DataServerInitializer extends {@link ChannelInitializer}&lt;{@link Channel}&gt; {
*     {@code @Override}
*     public void initChannel({@link Channel} channel) {
*         channel.pipeline().addLast("handler", <b>new DataServerHandler()</b>);

```



```

* }
* }
*
* </pre>
*
* <h4>Using { @link AttributeKey}s</h4>
*
* Although it's recommended to use member variables to store the state of a
* handler, for some reason you might not want to create many handler instances.
* In such a case, you can use { @link AttributeKey}s which is provided by
* { @link ChannelHandlerContext}:
* <pre>
* public interface Message {
*     // your methods here
* }
*
* { @code @Sharable}
* public class DataServerHandler extends { @link SimpleChannelInboundHandler}&lt;Message&gt; {
*     private final { @link AttributeKey}&lt;Boolean&gt; auth =
*         { @link AttributeKey#valueOf(String) AttributeKey.valueOf("auth")};
*
*     { @code @Override}
*     public void channelRead({ @link ChannelHandlerContext} ctx, Message message) {
*         { @link Attribute}&lt;Boolean&gt; attr = ctx.attr(auth);
*         if (message instanceof LoginMessage) {
*             authenticate((LoginMessage) o);
*             <b>attr.set(true)</b>;
*         } else (message instanceof GetDataMessage) {
*             if (<b>Boolean.TRUE.equals(attr.get())</b>) {
*                 ctx.writeAndFlush(fetchSecret((GetDataMessage) o));
*             } else {
*                 fail();
*             }
*         }
*     }
* }
* ...
* </pre>
*
* Now that the state of the handler is attached to the { @link ChannelHandlerContext}, you can add the
* same handler instance to different pipelines:
* <pre>
* public class DataServerInitializer extends { @link ChannelInitializer}&lt;Channel&gt; {
*
*     private static final DataServerHandler <b>SHARED</b> = new DataServerHandler();
*
*     { @code @Override}
*     public void initChannel({ @link Channel} channel) {
*         channel.pipeline().addLast("handler", <b>SHARED</b>);

```

```

*   }
* }
* </pre>
*
*
* <h4>The { @code @Sharable} annotation</h4>
* <p>
* In the example above which used an { @link AttributeKey},
* you might have noticed the { @code @Sharable} annotation.
* <p>
* If a { @link ChannelHandler} is annotated with the { @code @Sharable}
* annotation, it means you can create an instance of the handler just once and
* add it to one or more { @link ChannelPipeline}s multiple times without
* a race condition.
* <p>
* If this annotation is not specified, you have to create a new handler
* instance every time you add it to a pipeline because it has unshared state
* such as member variables.
* <p>
* This annotation is provided for documentation purpose, just like
* <a href="http://www.javaconcurrencyinpractice.com/annotations/doc/">the JCIP annotations</a>.
*
* <h3>Additional resources worth reading</h3>
* <p>
* Please refer to the { @link ChannelHandler}, and
* { @link ChannelPipeline} to find out more about inbound and outbound operations,
* what fundamental differences they have, how they flow in a pipeline, and how to handle
* the operation in your application.
*/

```

Found in path(s):

```

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-
jar/io/netty/channel/ChannelHandler.java

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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SimpleUserEventChannelHandler.java

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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelHandlerAdapter.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/DefaultChannelGroup.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultAddressedEnvelope.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressivePromise.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupException.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundBuffer.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelId.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/MessageSizeEstimator.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractEventLoopGroup.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroup.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelId.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatcher.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/DefaultOioSocketChannelConfig.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatchers.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ConnectTimeoutException.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/ChannelFactory.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioServerSocketChannelConfig.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/AddressedEnvelope.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressiveFutureListener.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioSocketChannelConfig.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressiveFuture.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SimpleChannelInboundHandler.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelProgressivePromise.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/DefaultOioServerSocketChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/SelectedSelectionKeySet.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFactory.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/embedded/EmbeddedChannelId.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractEventLoop.java
* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ReflectiveChannelFactory.java
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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/SimpleChannelPool.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/package-info.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/AbstractChannelPoolHandler.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultMaxBytesRecvByteBufAllocator.java

* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelPoolMap.java

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* /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/ChannelHealthChecker.java

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- * /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DuplexChannel.java
- * /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundInvoker.java
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- * /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/BootstrapConfig.java
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- * /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/AbstractBootstrapConfig.java
- * /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultSelectStrategy.java
- * /opt/ws_local/PERMITS_SQL/1072948476_1595240756.51/0/netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategy.java

1.109 hibernate-validator 6.1.5.Final

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1.113 libcap 2.22

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1.115 bzip2 1.0.8 2

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1.116 pkix-ssh 13.2.3

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Spring Framework 5.2.20.RELEASE

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1.120 spring-aspects 5.2.20.RELEASE

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jar/org/springframework/cache/aspectj/JCacheCacheAspect.aj
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-
jar/org/springframework/beans/factory/aspectj/AbstractDependencyInjectionAspect.aj
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-
jar/org/springframework/cache/aspectj/AbstractCacheAspect.aj
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* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-
jar/org/springframework/beans/factory/aspectj/GenericInterfaceDrivenDependencyInjectionAspect.aj
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* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-
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jar/org/springframework/transaction/aspectj/AbstractTransactionAspect.aj
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-
jar/org/springframework/transaction/aspectj/AspectJtaTransactionManagementConfiguration.java
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jar/org/springframework/beans/factory/aspectj/AbstractInterfaceDrivenDependencyInjectionAspect.aj
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* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/scheduling/aspectj/AspectJAsyncConfiguration.java
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/beans/factory/aspectj/AnnotationBeanConfigurerAspect.aj
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/transaction/aspectj/AspectJTransactionManagementConfiguration.java
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* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AspectJCCachingConfiguration.java
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AspectJCCacheConfiguration.java
* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AnyThrow.java

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* /opt/cola/permits/1301010865_1649210177.59/0/spring-aspects-5-2-20-release-sources-jar/org/springframework/transaction/aspectj/JtaAnnotationTransactionAspect.aj

1.121 jackson 2.11.2

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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/DelegatingAuthenticationEntryPoint.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/matcher/ELRequestMatcher.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/AccessDeniedHandler.java
- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/intercept/DefaultFilterInvocationSecurityMetadataSource.java
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- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/channel/ChannelDecisionManager.java
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- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationFilter.java
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- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/HttpSessionCreatedEvent.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.
java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandle
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/jackson2/DefaultCsrfServerTokenMixin.java

* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/jackson2/WebServerJackson2Module.java

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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfAuthenticationStrategy.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfToken.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/method/annotation/CsrfTokenArgumentResolver.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/bind/support/AuthenticationPrincipalArgumentResolver.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/HttpSessionCsrfTokenRepository.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/AnyRequestMatcher.java
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java
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- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/context/HttpSessionSecurityContextRepository.java
- * /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/csrf/CsrfWebFilter.java
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jar/org/springframework/security/web/context/HttpRequestResponseHolder.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/expression/DefaultWebSecurityExpressionHandler.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/servletapi/HttpServletRequest3RequestFactory.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/OnCommittedResponseWrapper.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedAuthenticationProvider.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/context/NullSecurityContextRepository.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/InvalidSessionStrategy.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/session/RegisterSessionAuthenticationStrategy.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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jar/org/springframework/security/web/authentication/rememberme/InvalidCookieException.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/RedirectStrategy.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-

jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedAuthenticationToken.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserAuthorityChanger.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/savedrequest/RequestCacheAwareFilter.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/AbstractRetryEntryPoint.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/context/SecurityContextPersistenceFilter.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/intercept/package-info.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/savedrequest/SavedRequest.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/SessionManagementFilter.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/x509/X509PrincipalExtractor.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/InMemoryTokenRepositoryImpl.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AuthenticationFailureHandler.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/RedirectUrlBuilder.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/DefaultRedirectStrategy.java
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jar/org/springframework/security/web/servlet/util/matcher/MvcRequestMatcher.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/csrf/CookieCsrfTokenRepository.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/SessionInformationExpiredEvent.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/expression/DelegatingEvaluationContext.java

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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/authorization/AuthorizationWebFilter.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/authentication/logout/LogoutWebFilter.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/util/matcher/AndServerWebExchangeMatcher.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/savedrequest/CookieServerRequestCache.java

* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/context/WebSessionServerSecurityContextRepository.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/RequestRejectedHandler.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/HttpSessionIdChangedEvent.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/authentication/AuthenticationConverterServerWebExchangeMatcher.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/DelegatingServerAuthenticationEntryPoint.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/session/SessionFixationProtectionStrategy.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/savedrequest/WebSessionServerRequestCache.java
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* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/util/matcher/OrServerWebExchangeMatcher.java
* /opt/cola/permits/1351887195_1656319607.7368119/0/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/authentication/AuthenticationWebFilter.java

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

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```

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```
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```

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```
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```

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

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```

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

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*
* Author: Adam Dunkels <adam@sics.se>
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```
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1.126 goprotobuf 2.4.1

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1.127 pcre 8.39-12ubuntu0.1

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1.128 spring-test 5.2.20.RELEASE

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1.129 dav1d 0.6.0

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1.130 tomcat-embed-websocket 9.0.37

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jar/io/netty/channel/epoll/AbstractEpollStreamChannel.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/EpollDomainSocketChannelConfig.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/EpollChannelConfig.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/EpollEventArray.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/EpollServerDomainSocketChannel.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/EpollMode.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/TcpMd5Util.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/EpollRecvByteAllocatorStreamingHandle.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-  
jar/io/netty/channel/epoll/AbstractEpollServerChannel.java  
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
```

```
jar/io/netty/channel/epoll/EpollServerChannelConfig.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollRecvByteAllocatorHandle.java
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/EpollDomainSocketChannel.java
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*/
/**
 * Set the {@code TCP_MD5SIG} option on the socket. See {@code linux/tcp.h} for more details.
 * Keys can only be set on, not read to prevent a potential leak, as they are confidential.
 * Allowing them being read would mean anyone with access to the channel could get them.
 */
```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-
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*/

/**

* Set the {`TCP_MD5SIG`} option on the socket. See {`linux/tcp.h`} for more details.

* Keys can only be set on, not read to prevent a potential leak, as they are confidential.

* Allowing them being read would mean anyone with access to the channel could get them.

*/

/**

* Set the {`TCP_QUICKACK`} option on the socket. See [TCP_QUICKACK](http://linux.die.net/man/7/tcp)

* for more details.

*/

Found in path(s):

* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io.netty/channel/epoll/EpollSocketChannelConfig.java

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- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDatagramChannel.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/Epoll.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/package-info.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollServerSocketChannel.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventLoop.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventLoopGroup.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelOption.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollChannel.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollSocketChannel.java
- * /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollTcpInfo.java

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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_native.c

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* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_linuxsocket.h

* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/LinuxSocket.java

* /opt/ws_local/PERMITS_SQL/1075084041_1596044813.39/0/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/NativeStaticallyReferencedJniMethods.java

1.132 ehcache-core 3.8.1

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* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/ZeroOperationStatistic.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/EhcacheManager.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/TimeSource.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/PersistentUserManagedEhcache.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/exceptions/ExceptionFactory.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/LifeCycledAdapter.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEventFilter.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/InternalStatus.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/LatencyHistogramConfiguration.java
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* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/LowerCachingTier.java

* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/EhcacheBase.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/store/StoreStatisticsConfiguration.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/StatsUtils.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/ConfigurationChangeSupport.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/TierStatistics.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/HumanReadable.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/LocalPersistenceService.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/StatisticsService.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEventListenerConfiguration.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/exceptions/StorePassThroughException.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/StatusTransitioner.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/Ehcache.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/TickingTimeSource.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEventListenerProvider.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/SpecIterator.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/heap/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/LowerCachingTierOperationsOutcome.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/HigherCachingTierOperationOutcomes.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheManagerListener.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/heap/SizeOfEngineProvider.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/StateChangeListener.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/CacheConfigurationProperty.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/Store.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-

jar/org/ehcache/core/InternalCache.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/tiering/HigherCachingTier.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/config/CoreConfigurationBuilder.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/service/FileBasedPersistenceContext.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/tiering/AuthoritativeTier.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/events/NullStoreEventDispatcher.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/DefaultStatisticsService.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/WrapperStore.java
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jar/org/ehcache/core/statistics/CachingTierOperationOutcomes.java
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* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/events/StoreEventDispatcher.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/config/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/LifeCycled.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/service/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/InternalRuntimeConfiguration.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/heap/LimitExceededException.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/OperationObserver.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/SourceStatistic.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/TierOperationOutcomes.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/CacheStatistics.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/DefaultCacheStatistics.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/service/DiskResourceService.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/EhcacheRuntimeConfiguration.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-

jar/org/ehcache/core/statistics/StoreOperationOutcomes.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/resilience/DefaultRecoveryStore.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/exceptions/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/CacheConfigurationChangeEvent.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/BulkOps.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/DelegatingOperationStatistic.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/events/StoreEventSource.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/service/ServiceUtils.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/ServiceLocator.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/events/StoreEvent.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/AuthoritativeTierOperationOutcomes.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/osgi/SafeOsgi.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/DelegatingOperationObserver.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/CacheConfigurationChangeListener.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/util/ClassLoading.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/util/ByteBufferInputStream.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/InternalCacheManager.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/SuppliedValueStatistic.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/DefaultTierStatistics.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/events/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/DefaultCacheManagerProviderService.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/config/store/package-info.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/ChainedObserver.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/config/ExpiryUtils.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-

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jar/org/ehcache/core/spi/store/AbstractWrapperStoreProvider.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/ChainedOperationObserver.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/store/StoreSupport.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/tiering/CachingTier.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/service/ServiceFactory.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/AbstractValueHolder.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/time/SystemTimeSource.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/heap/SizeOfEngine.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/osgi/OsgiServiceLoader.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/time/TimeSourceService.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/spi/store/events/StoreEventListener.java
* /opt/cola/permits/1258059284_1643027245.56/0/ehcache-core-3-8-1-sources-
jar/org/ehcache/core/statistics/DelegatedMappedOperationStatistics.java

```

1.133 management-model 5.7.3

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```

Found in path(s):

```

* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-

```

jar/org/terracotta/management/model/message/DefaultManagementCallMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/Sample.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/call/ContextualCall.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/DelegatingStatistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/Descriptor.java
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jar/org/terracotta/management/model/stats/Statistic.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/context/CapabilityContext.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/call/Parameter.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/CallDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/ContextualStatistics.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/descriptors/StatisticDescriptor.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/DefaultCapability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/ContextContainer.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/Context.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/capabilities/Capability.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/ManagementCallMessage.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/StatisticRegistry.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/DefaultMessage.java
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jar/org/terracotta/management/model/call/ContextualReturn.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/message/Message.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/cluster/ClientIdentifier.java
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jar/org/terracotta/management/model/capabilities/descriptors/Settings.java
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jar/org/terracotta/management/model/notification/ContextualNotification.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/context/Contextual.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-

jar/org/terracotta/management/model/stats/StatisticType.java
* /opt/cola/permits/1258059149_1643027380.56/0/management-model-5-7-3-sources-
jar/org/terracotta/management/model/stats/DelegatingSample.java

1.134 importlib-metadata 0.18

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1.135 hd-parm 9.48

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1.136 expat 2.2.4

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1.137 libcap 2.25

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1.142 hibernate 5.4.20.Final

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1.143 luaposix 5.1.28

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1.144 servlet-api 4.0.0

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```
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/HttpServlet.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/AbstractHttpServlet.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/SimpleLruCache.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/ServletURIPool.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/TlsHelper.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/ServletURI.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-
jar/org/xipki/http/servlet/SslReverseProxyMode.java
* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-jar/org/xipki/http/servlet/package-
```

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Found in path(s):

* /opt/cola/permits/1320304756_1651519748.12/0/servlet-api-4-0-0-sources-4-jar/META-
INF/maven/org.xipki/servlet-api/pom.xml

1.145 activation-api 1.2.2

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1.146 commons-dbcp 1.4

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1.147 Ivm2 2.02.79

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```
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```

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```

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

```
@end smallexample
```

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1.152 selinux 2.8-1+b1

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```

```
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-  
jar/org/HdrHistogram/DoubleLinearIterator.java
```

```
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-  
jar/org/HdrHistogram/PackedConcurrentDoubleHistogram.java
```

```
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-  
jar/org/HdrHistogram/SynchronizedHistogram.java
```

```
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-  
jar/org/HdrHistogram/packedarray/PackedArraySingleWriterRecorder.java
```

```
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-  
jar/org/HdrHistogram/Histogram.java
```


* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/LogarithmicIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Version.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/RecordedValuesIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/LinearIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedDoubleHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AtomicHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramIterationValue.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Recorder.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ConcurrentDoubleHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogReader.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogProcessor.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterDoubleRecorder.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecorder.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleHistogramIterationValue.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AbstractHistogramIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SynchronizedDoubleHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PercentileIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedConcurrentHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecordedValuesIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleAllValuesIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterRecorder.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleLogarithmicIterator.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ShortCountsHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-

```
jar/org/HdrHistogram/EncodableHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/HistogramLogScanner.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/packedarray/PackedArrayRecorder.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/ConcurrentHistogram.java
No license file was found, but licenses were detected in source scan.
```

```
/*
* Written by Gil Tene of Azul Systems, and released to the public domain,
* as explained at http://creativecommons.org/publicdomain/zero/1.0/
*
* @author Gil Tene
*/
```

```
Found in path(s):
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/AbstractHistogram.java
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-
jar/org/HdrHistogram/DoubleHistogram.java
No license file was found, but licenses were detected in source scan.
```

```
/*
* package-info.java
* Written by Gil Tene of Azul Systems, and released to the public domain,
* as explained at http://creativecommons.org/publicdomain/zero/1.0/
*/
```

```
Found in path(s):
* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/package-
info.java
No license file was found, but licenses were detected in source scan.
```

```
/**
* Written by Gil Tene of Azul Systems, and released to the public domain,
* as explained at http://creativecommons.org/publicdomain/zero/1.0/
*
* @author Gil Tene
*/
```

```
package org.HdrHistogram;
```

```
final class Version {
    public static final String version="$VERSION$";
    public static final String build_time="$BUILD_TIMES$";
}
```

Found in path(s):

* /opt/cola/permits/1257203437_1642787675.09/0/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Version.java.template

1.155 jboss-logging 3.4.1.Final

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1.156 ethtool 4.6

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1.157 stunnel 5.56

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The original code is FirewallControl.pas, released April 16, 2007.

The initial developer of the original code is Rainer Budde (<http://www.speed-soft.de>).

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1.158 Im-sensors 3.3.1

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```
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```

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```
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```

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That's all there is to it!
Here is a list of the main contributors to lm-sensors version 3.

- * Frodo Looijaard
Original author of libsensors, sensors-detect, sensors and isadump.
- * Merlin Hughes
Original author of sensord.
- * Bob Schlaermann
Dynamic chip feature detection (a.k.a. generic chip support) in libsensors and sensors.
- * Mark M. Hoffman

Many improvements to the libsensors configuration file scanner.
* Jean Delvare
New libsensors API, and migration of sensors and sensord thereto.
Many optimizations in libsensors and sensors.
Configuration file converter.
Rewrite of sensors-detect.
Support for multiple configuration files in libsensors.

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Upstream-Name: Nettle

Upstream-Contact: Niels Miller <nisse@lysator.liu.se>

Source: <http://www.lysator.liu.se/~nisse/nettle/>

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AES

The implementation of the AES cipher (also known as rijndael) is written by Rafael Sevilla. Assembler for x86 by Rafael Sevilla and Niels Miller, Sparc assembler by Niels Miller. Released under the LGPL.

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ARCFOUR

The implementation of the ARCFOUR (also known as RC4) cipher is written by Niels Miller. Released under the LGPL.

.

ARCTWO

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BLOWFISH

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CAMELLIA

The C implementation is by Nippon Telegraph and Telephone Corporation (NTT), heavily modified by Niels Mller. Assembler for x86 and x86_64 by Niels Mller. Released under the LGPL.

CAST128

The implementation of the CAST128 cipher is written by Steve Reid. Released into the public domain.

DES

The implementation of the DES cipher is written by Dana L. How, and released under the LGPL.

MD2

The implementation of MD2 is written by Andrew Kuchling, and hacked some by Andreas Sigfridsson and Niels Mller. Python Cryptography Toolkit license (essentially public domain).

MD4

This is almost the same code as for MD5 below, with modifications by Marcus Comstedt. Released into the public domain.

MD5

The implementation of the MD5 message digest is written by Colin Plumb. It has been hacked some more by Andrew Kuchling and Niels Mller. Released into the public domain.

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SHA1

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SHA224, SHA256, SHA384, and SHA512

Written by Niels Mller, using Peter Gutmann's SHA1 code as a model. Released under the LGPL.

.

TWOFISH

The implementation of the TWOFISH cipher is written by Ruud de Rooij. Released under the LGPL.

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RSA

Written by Niels Mller, released under the LGPL. Uses the GMP library for bignum operations.

.

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jar/io/netty/handler/codec/socks/SocksRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socks/SocksAuthRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socks/SocksCmdRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socks/SocksAuthResponseDecoder.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
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jar/io/netty/handler/codec/socksx/v5/DefaultSocks5InitialRequest.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socks/SocksMessageEncoder.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socksx/v4/Socks4CommandStatus.java
* /opt/ws_local/PERMITS_SQL/1077639554_1597066895.65/0/netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socks/package-info.java

1.163 Idns 1.7.1

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1.164 ethtool 3.2

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1.168 python-setuptools 8.8.0

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PSF

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

principal author, although it includes many contributions from others.

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

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

All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Release from	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
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Files:

tests/test-update-copyright.sh

Depends-on:

configure.ac:

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

Makefile.am:

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

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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@item

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@var{one line to give the library's name and an idea of what it does.}

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`Frob' (a library for tweaking knobs) written by James Random Hacker.

@var{signature of Ty Coon}, 1 April 1990

Ty Coon, President of Vice

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That's all there is to it!

Files:

tests/test-canonicalize-lgpl.c

tests/signature.h

tests/null-ptr.h

tests/macros.h

Depends-on:

ignore-value

same-inode

symlink

configure.ac:

Makefile.am:

TESTS += test-canonicalize-lgpl

check_PROGRAMS += test-canonicalize-lgpl

\$Id: COPYING,v 1.3 2006-10-26 16:20:28 eggert Exp \$

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@c hence no sectioning command or @node.

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@page
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@end smallexample

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

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

@smallexample

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

Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.

This is free software, and you are welcome to redistribute it under certain conditions; type `show c' for details.

@end smallexample

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

You should also get your employer (if you work as a programmer) or your school, if any, to sign a ``copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

@example

Yoyodyne, Inc., hereby disclaims all copyright interest in the program

`Gnomovision' (which makes passes at compilers) written by James Hacker.

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

Ty Coon, President of Vice

@end example

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License.

Description:

Concatenate two arbitrary file names.

Files:

lib/filenamecat.h

lib/filenamecat-lgpl.c

m4/filenamecat.m4

Depends-on:

dirname-lgpl

configure.ac:

gl_FILE_NAME_CONCAT_LGPL

Makefile.am:

lib_SOURCES += filenamecat-lgpl.c

Include:

"filenamecat.h"

License:

LGPLv2+

Maintainer:

Jim Meyering

Please email the following information to assign@gnu.org, and we will send you the assignment form for your past and future changes.

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

REQUEST: SEND FORM FOR PAST AND FUTURE CHANGES

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

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

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

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

[What year were you born?]

[Please write your email address here.]

[Please write your postal address here.]

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

Description:

Provide the GNU Free Documentation License in Texinfo format.

Files:

doc/fdl.texi

Depends-on:

configure.ac:

Makefile.am:

Include:

License:

unmodifiable license text

Maintainer:

all

Description:

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

Files:

doc/relocatable.texi

lib/relocatable.h

lib/relocatable.c
lib/relocatable.valgrind
m4/relocatable-lib.m4

Depends-on:

strdup

configure.ac:

```
gl_RELOCATABLE_LIBRARY
if test $RELOCATABLE = yes; then
  AC_LIBOBJ([relocatable])
fi
```

Makefile.am:

```
DEFS += -DNO_XMALLOC
```

Include:

```
"relocatable.h"
```

License:

GPLv2+

Maintainer:

Ben Pfaff

Description:

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

Files:

lib/getcwd-lgpl.c
m4/getcwd.m4

Depends-on:

unistd

strdup [test \$REPLACE_GETCWD = 1]

configure.ac:

```
gl_FUNC_GETCWD_LGPL
if test $REPLACE_GETCWD = 1; then
  AC_LIBOBJ([getcwd-lgpl])
fi
gl_UNISTD_MODULE_INDICATOR([getcwd])
```

Makefile.am:

Include:

```
<unistd.h>
```

License:

LGPLv2+

Maintainer:

Eric Blake

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

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

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

* Assign the copyright to the Free Software Foundation.

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

* Keep the copyright and release the program yourself under the GNU GPL. (This alternative is too impractical for contributions to a preexisting FSF-copyrighted GNU program.)

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

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

* Assigning copyright.

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

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The assignment contract we normally use has a clause that permits you to use your code in proprietary programs, on 30 days' notice. (The 30 days' notice is there because, through a legal technicality, it would improve our position in a suit against a hoarder.) Although we believe that proprietary software is wrong, we include this clause because it would serve no purpose to ask you to promise not to do it. You're giving us a gift in the first place.

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You can release a program yourself under copyleft distribution terms such as the GNU GPL. (In order to accept the program as GNU software, we would have to be happy with your choice of terms.) This does not require a contract between you and the FSF, but we would appreciate having a signed piece of paper to confirm your decision.

If someone violates your terms--for example, if someone gets a copy from us, and uses it as a basis for a proprietary product in violation of the terms--we cannot sue him. You would have to sue, or he gets away with it.

* Public domain.

If you put the program in the public domain, we prefer to have a signed piece of paper--a disclaimer of rights--from you confirming this. If the program is not very important, we can do without one; the worst that could happen is that we might some day be forced to stop using it.

The law says that anyone can copyright a modified version of the public domain work. (This doesn't restrict the original, which remains in the public domain; only the changes are copyrighted.) If we make extensive changes, we will probably do this and add our usual copyleft. If we make small changes, we will leave the version we distribute in the public domain.

* What about your employer?

If you are employed to do programming, or have made an agreement with your employer that says it owns programs you write, we need a signed piece of paper from your employer disclaiming rights to the program. It should be signed by a vice president or general manager of the company. If you

can't get at them, it is almost as good to find someone who signs licenses for software that is purchased. Here is a sample wording:

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

<signature of Mo Ghoul>, 1 April 1987

Mo Ghoul, President of Vice, Digital Simulation Corp.

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

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

...in the changes and enhancements made by Hugh Hacker to the program "sample.el".

* Did anyone else contribute?

If someone else contributed more than a few lines here or there to the program, then that person too is an author, and that person too needs to sign papers just as you do. So may that person's employer. However, if his contribution is just a fraction of the whole work, it is satisfactory if he disclaims his own rights, even if you are assigning yours. (If just the minor contributors' work goes in the public domain, that doesn't leave much of a loophole for hoarders.)

If you incorporated packages which you found floating around as "public domain", we might still want to track down their authors, to get disclaimers to reassure us that they really are in the public domain. So keep track of what these packages are and who wrote them.

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In working on a project for GNU, DO NOT study and follow any Unix sources or other non-free software that might have any bearing on the project. Don't refer to them at all, unless you are forced to for non-GNU reasons.

It is not considered a serious problem if you have read Unix sources or other non-free source code in the past for other purposes, provided you don't copy anything in particular from them. However, referring to them while you do the work could cause us legal problems later.

Description:

Locating a program in PATH (LGPLed version).

Files:

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

Depends-on:

stdbool
strdup
concat-filename
access
unistd

configure.ac:

gl_FINDPROG
gl_MODULE_INDICATOR([findprog-lgpl])

Makefile.am:

lib_SOURCES += findprog.h findprog.c

Include:

"findprog.h"

License:

GPLv2+

Maintainer:

all

The files in this directory describe the gnu lib modules.
The following copyright notice applies to each of these
description files.

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Version 2, June 1991

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

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

If the program is interactive, make it output a short notice like this
when it starts in an interactive mode:

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

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

You should also get your employer (if you work as a programmer) or your
school, if any, to sign a "copyright disclaimer" for the program, if
necessary. Here is a sample; alter the names:

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

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

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Version 2.1, February 1999

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

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[Please list the files involved, or give a brief description of the changes being disclaimed.]

Files:

tests/test-getcwd-lgpl.c

tests/signature.h

tests/macros.h

Depends-on:

configure.ac:

Makefile.am:

TESTS += test-getcwd-lgpl

check_PROGRAMS += test-getcwd-lgpl

test_getcwd-lgpl_LDADD = \$(LDADD) \$(LIBINTL)

Description:

realpath, canonicalize_file_name: Provide canonical absolute file name

Files:

lib/canonicalize-lgpl.c

m4/canonicalize.m4

m4/double-slash-root.m4

Depends-on:

extensions

stdlib

nocrash

alloca-opt [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

errno [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

lstat [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test \$REPLACE_CANONICALIZE_FILE_NAME
= 1]

malloca [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

memmove [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

pathmax [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

readlink [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

sys_stat [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

configure.ac:

gl_CANONICALIZE_LGPL

if test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test \$REPLACE_CANONICALIZE_FILE_NAME = 1; then
AC_LIBOBJ([canonicalize-lgpl])

fi

gl_MODULE_INDICATOR([canonicalize-lgpl])

gl_STDLIB_MODULE_INDICATOR([canonicalize_file_name])

gl_STDLIB_MODULE_INDICATOR([realpath])

Makefile.am:

Include:
<stdlib.h>

License:
LGPLv2+

Maintainer:
all

Description:
Extract specific portions of filenames.

Files:
lib/dirname.h
lib/dirname-lgpl.c
lib/basename-lgpl.c
lib/stripslash.c
m4/dirname.m4

Depends-on:
dosname
double-slash-root
malloc-posix
stdbool

configure.ac:
gl_DIRNAME_LGPL

Makefile.am:
lib_SOURCES += dirname-lgpl.c basename-lgpl.c stripslash.c

Include:
"dirname.h"

License:
LGPLv2+

Maintainer:
Jim Meyering, Eric Blake

1.170 rpcbind 6.0

1.170.1 Available under license :

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- */

1.171 classgraph 4.8.69

1.171.1 Available under license :

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1.172 pam 1.5.2

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Version 2.1, February 1999

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^L

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must

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1.173 zlib 1.2.8

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/* zlib.h -- interface of the 'zlib' general purpose compression library
version 1.2.11, January 15th, 2017

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1.174 pam 1.1.5

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1.175 hd-parm 9.38

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1.176 isof 4.85

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/*

* GetOpt() -- Local get option

*

* Borrowed from lsof's main.c source file.

*

* Liberally adapted from the public domain AT&T getopt() source,
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*

* The modifications allow '?' to be an option character and allow
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- *
- * @(#)netdb.h 5.15 (Berkeley) 4/3/91
- */

Found in path(s):

* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/osr/include/netdb.h

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Frequently Asked Questions about lsof

```
*****
| The latest release of lsof is always available via anonymous ftp |
| from lsof.itap.purdue.edu. Look in pub/lsof.README for its    |
| location.                                                    |
*****
```

This file contains frequently asked questions about lsof and answers to them.

Vic Abell <abe@purdue.edu>

September 27, 2011

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- 16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?
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- 17.5 Where are the Solaris header files?
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- 17.7 Why does Solaris lsof say "can't read proc table"?
- 17.8 Why does Solaris lsof complain about a bad cached clone device?
- 17.9 Why doesn't Solaris make generate .o files?
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 - 17.12.6 What gcc will produce 64 bit Solaris 7, 8 and 9 executables?
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failure?

17.23 Solaris and SAM-FS

17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?

17.23.2 Why can't lsof locate named SAM-FS files?

17.24 Lsof and Solaris 10 zones

17.24.1 How can I make lsof list the Solaris zone?

17.24.2 Why doesn't lsof work in a Solaris 10 zone?

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17.25 Solaris 10 problems

17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?

17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?

17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?

17.25.4 What does "(?)" mean in the NAME column of a Solaris 10 open file?

17.26 Solaris contract file problems

17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?

17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?

17.27 Solaris 10 ZFS problems

17.27.1 Why does Configure ask for the location of ZFS header files?

17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS structure definitions?

17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?

17.28 Problems with Solaris 9 and above

17.28.1 Why does the compiler complain about lgrp_root on Solaris 9 and above?

18.0 Lsof Features

18.1 Why doesn't lsof report on /proc entries on my system?

18.2 How do I disable the device cache file feature or alter its behavior?

18.2.1 What's the risk with a perverted device cache file?

18.2.2 How do I put the full host name in a personal device cache file path?

18.2.3 How do I put the personal device cache file in /tmp?

18.3 Why doesn't lsof know about AFS files on my favorite dialect?

18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

1.0 General Concepts

1.1 Lsof -- what is it?

Lsof is a UNIX-specific tool. Its name stands for LiSt Open Files, and it does just that. It lists information about files that are open by the processes running on a UNIX system.

See the lsof man page, the 00DIST file, the 00QUICKSTART file, and the 00README file of the lsof distribution for more information.

1.2 Where do I get lsof?

Lsof is available via anonymous ftp from [lsof.itap.purdue.edu](ftp://lsof.itap.purdue.edu). Look in the `pub/tools/unix/lsof` sub-directory.

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof`

Bzip2'd, compressed and gzip'd tar files with GPG certificates are available.

1.2.1 Are there mirror sites?

On April 28, 2009 these sites appeared to have the latest lsof revision:

`ftp://ftp.fu-berlin.de/pub/unix/tools/lsof`

`ftp://sunsite.ualberta.ca/pub/Mirror/lsof`

1.2.2 Are lsof executables available?

Some lsof executables are available in the subdirectory tree `pub/tools/unix/lsof/binaries`. These are neither guaranteed to be current nor cover every dialect and machine architecture.

I don't recommend you use pre-compiled lsof binaries; I recommend you obtain the sources and build your own binary. Even if you're a Sun user without a Sun C compiler, you can use gcc to compile lsof.

If you must use a binary file, please be conscious of the security and configuration implications in using an executable of unknown or different origin. The lsof binaries are accompanied by GPG certificates. Please use them!

Three additional cautions apply to executables:

1. Don't try to use an lsof executable, compiled for one

version of a UNIX dialect, on another. Patches can make the dialect version different.

2. If you want to use an lsof binary on multiple systems, they must be running the same dialect OS version and have the same patches and feature support.

1.2.3 How do I check the validity of an lsof distribution?

There are two ways to check the validity of an lsof distribution:

1. Follow the instructions in the CHECKSUMS_<revision> file found with the lsof distribution.

Checking with GPG is the best method.

2. Follow the instructions in the "Security" section of the README.lsof_<revision> file found inside the lsof distribution.

Again, checking with GPG is the best method.

1.2.4 Why can't I get the sum(1) result reported in README.lsof_<revision>?

The "Security" section of the README.lsof_<revision> file found inside the lsof distribution gives md5, sum, and GPG certificate information.

The simplest, the sum(1) signature, seems to be the trickiest. That's because there are different sum(1) methods, BSD systems usually have cksum(1) instead of sum(1), and different systems compute the block size value differently.

First, the lsof sum results are computed with the old, "alternate" algorithm. On newer systems, you can use sum's "-r" option to get that computation result.

Second, on BSD systems you usually must use cksum(1) instead of sum(1), because they have no sum(1). To tell cksum(1) to use the old, "alternate" algorithm, use its "-o1" option.

Third, the second value that sum reports, the block count, may be computed differently on different systems -- usually block size is considered to be 512 or 1,024. The lsof block counts were computed on a system with a sum(1) option that considers block size to be 512. The BSD system cksum(1) -o1 option

considers block size to be 1,024. If your `sum(1)` or `cksum(1)` doesn't report a block count that matches the `sum(1)` signature given in `README.lsof_<revision>`, check its man page to see what block size it uses, then adjust its reported block count appropriately.

1.2.5 Why won't gpg accept the lsof-signing PGP public key?

An older PGP key that once signed lsof distributions is included in lsof revisions prior to 4.70. The PGP key is indeed my key, but is incompatible with GPG. It was created about ten years ago and is still acceptable to PGP versions 2.6.2 through 6.5.2.

Lsof revisions 4.70 and above are signed with a copy of my PGP key that has been made acceptable for use with GPG by importing it under GPG's "`--allow-non-selfsigned-uid`" option.

You can find my GPG compatible key in lsof revisions 4.70 and above and at:

```
ftp://lsof.itap.purdue.edu/pub/Victor_A_Abell.gpg
```

If you have an older lsof revision with my PGP key, there are two possible ways to use it:

- * Use it with a PGP version from 2.6.2 through 6.5.2.

- * Use GPG's "`--allow-non-selfsigned-uid`" option when you import my PGP key into your GPG key ring.

```
$ gpg --allow-non-selfsigned-uid --import Victor_A_Abell.gpg
```

1.3 Where can I get more lsof documentation?

A significant set of documentation may be found in the lsof distribution (See "Where can I get lsof?"). There is a manual page, copious documentation in files whose names begin with 00, and a copy of this FAQ in the file 00FAQ (perhaps slightly less recent than this file if you're reading it via a web browser.)

Two URLs provide some documentation that appears in the lsof distribution:

FAQ: <ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

man page: ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man

1.4 How do I report an lsof bug?

If you believe you have discovered a bug in lsof, you can report it via e-mail to <abe@purdue.edu>. Do NOT report lsof bugs to the UNIX dialect vendor. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

Before you send me a bug report, please read the "Bug Reports" section of the 00README file of the lsof distribution. It lists the steps you should take before and when reporting a suspected bug.

1.5 Where can I get the lsof FAQ?

This lsof FAQ is available in the file 00FAQ in the lsof distribution and at the URL:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ`

1.5.1 How timely is the on-line FAQ?

The on-line FAQ is sometimes too timely. :-)

I update it as soon as new information is available. That may include information about support that won't appear in the lsof source distribution until the next revision. If you encounter something like that, please send me e-mail at <abe@purdue.edu>. I may be able to point you at a pre-release distribution that contains the support of interest. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

1.6 Is there a test suite?

Yes, as of lsof revision 4.63 there's an automated lsof test suite in the tests/ sub-directory of the lsof top-level directory.

More information on using the test suite, what it does, how to use it and how to configure it may be found in the 00TEST file of the lsof distribution. That file also explains where the test suite has been tested.

Frequently asked questions about the test suite will be asked and answered here in the FAQ. (See "Test Suite Problems.")

After lsof has been configured with the Configure script, lsof can be made and tested with:

```
$ make
$ cd tests
$ make
```

Under normal conditions -- i.e., unless the lsof tree has been cleaned or purged severely -- all tests or individual tests may be run by:

```
$ cd test
$ make
or
$ <run a single test> (See 00TEST.)
```

1.7 Is lsof vulnerable to the standard I/O descriptor attack?

Lsof revisions 4.63 and above are not vulnerable.

Lsof revisions 4.62 and below are vulnerable, but no damage scenarios have so far been demonstrated.

The standard I/O descriptor attack is a local programmed assault on setuid and setgid programs that tricks them into opening a sensitive file with write access on a standard descriptor, usually stderr (2), and writing error messages to stderr. If the attacker can control the content of the error message, the attacker may gain elevated privileges.

The attack was first described in Pine Internet Advisory PINE-CERT-20020401, available at:

<http://www.pine.nl/advisories/pine-cert-20020401.txt>

If you are using an lsof revision below 4.63, you should remove any setuid or setgid permissions you might have given its executable. Then you should upgrade to lsof revision 4.63.

1.8 Can I alter lsof's make(1) behavior?

Yes. There are at least two ways to do that.

You can put replacements for lsof Makefile strings in your environment. If you specify the -e make option, make will give environment variable values precedence over strings from the Makefile. For example, to change the compiler

string CC from the environment, you might do this with the Bourne shell:

```
$ CC=foobar; export CC
$ make -e
```

You can also replace Isof Makefile strings in the make command invocation. Here's the previous example done that way:

```
$ make CC=foobar
```

Changing the CFGF, CFGL, and DEBUG strings used in Isof Makefiles, either from the environment or from the make invocation, can significantly alter Isof make(1) behavior. I commonly use DEBUG to change the -O option to -g so I can build an Isof executable for debugging -- e.g.,

```
$ make DEBUG=-g
```

(Look for DEBUG in this FAQ for other examples of its use.)

Consult the Makefiles to see what CFGL, CFGL, and other Isof Makefile strings contain, and to see what influence their alteration might have on Isof make(1) behavior.

1.9 Is there an Isof license?

No.

The only restriction on the use or redistribution of Isof is contained in this copyright statement, found in every Isof source file. (The copyright year in or format of the notice may vary slightly.)

```
/*
 * Copyright 2002 Purdue Research Foundation, West Lafayette,
 * Indiana 47907. All rights reserved.
 *
 * Written by Victor A. Abell
 *
 * This software is not subject to any license of the American
 * Telephone and Telegraph Company or the Regents of the
 * University of California.
 *
 * Permission is granted to anyone to use this software for
 * any purpose on any computer system, and to alter it and
 * redistribute it freely, subject to the following
```

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*

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*

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* authors and Purdue University must appear in documentation
* and sources.

*

* 3. Altered versions must be plainly marked as such, and must
* not be misrepresented as being the original software.

*

* 4. This notice may not be removed or altered.

*/

1.10 Language locale support

1.10.1 Does lsof support language locales? How do I use the support?

Most UNIX dialect versions of lsof support 8 bit language locale characters -- e.g., the ability to print 8 bit characters that have accents and other marks over them.

See the answer to the "Does lsof support wide characters in language locales?" question for information on when lsof's language locale support covers characters wider than 8 bits.

To see if lsof supports language locales for your dialect, look in the dialect's machine.h header file for the HASSETLOCALE definition. If it is present and not disabled, then lsof has language locale support for the dialect.

To enable lsof's language locale support, you must specify in a locale environment variable (e.g., LANG) a language locale known to your system that supports the printing of marked characters -- e.g, en_US. (On some dialects locale(1) may be used to list the known language locales.)

Note that LANG=C and LANG=POSIX are NOT language locales that support the printing of marked characters.

If the language locale doesn't support the printing of marked characters, lsof's OUTPUT of them follows the rules for non-printable characters described in the OUTPUT section of lsof(8).

Consult your dialect's setlocale(3) man page for the names of

environment variables other than LANG -- e.g., LC_ALL, LC_TYPE, etc. -- which may be used to define language locales.

1.10.2 Does lsof support wide characters in language locales?

When lsof's language locale support is enabled with the HASSETLOCALE definition, for selected dialects lsof will also print wide characters (e.g., from UTF-8) when iswprint(3) reports them to be printable.

Wide character support is available when HASWIDECHAR is defined in a dialect's machine.h header file. As of this writing on July 22, 2004, the following dialect versions have wide character support:

- AIX >= 4.3.2
- Apple Darwin >= 7.3.0
- FreeBSD >= 5.2
- HP-UX >= 11.00
- /proc-based Linux
- NetBSD >= 1.6
- SCO OpenServer >= 5.0.6
- Solaris >= 2.6
- Tru64 UNIX 5.1

1.11 Are any files in the lsof distribution copyrighted?

Yes. Most files carry the copyright of the Purdue Research Foundation and may be redistributed under the terms that accompany the copyright notice. Those terms may also be found in the answer to the question, "Is there an lsof license?")

A few files carry other copyright notices. Some are BSD notices and they explain the terms under which they are included in the lsof distribution.

Those that carry vendor copyright notices have been reproduced in their original or modified forms with permission from the copyright owners. That permission is indicated in the README files that accompany the files.

1.12 Are there other lsof-related resources?

There are other resources available, connected to lsof. Among them are FreeBSD and Linux packages whose products use lsof and two particularly interesting resources.

The two interesting resources are a Gnome Tool Kit (GTK) GUI

for lsof and a Perl wrapper module.

The GTK GUI is called Glsof and was developed by Gnele. It can be found at:

<http://www.sourceforge.net>

The Perl wrapper module by Marc Beyer can be found at:

<http://search.cpan.org/dist/Unix-Lsof/>

1.13 What does the "WARNING: unsupported dialect or version" mean?

The lsof configure script issues that message for UNIX dialects or their versions where I have been unable to test the current revision of lsof. The message doesn't mean that lsof won't work, just that I have no direct evidence that it will.

If the COnfigure script succeeds, except for the warning, try compiling lsof. If that succeeds, try the lsof test suite.

2.0 Lsof Ports

2.1 What ports exist?

The pub/lsof.README file carries the latest port information:

AIX 5.[23] and 5.3
FreeBSD 4.9 and 6.4 for x86-based systems
FreeBSD 8.[02] for AMD64-based systems
Linux 2.1.72 and above for x86-based systems
Solaris 9, 10 and 11

In the above list the only UNIX dialects present are ones for which I test the current lsof revision. Lsof may still support unlisted dialect versions -- e.g., HP-UX 10.20, Solaris 7, etc. -- but I don't have access to systems where I could test lsof on them, so I can't claim lsof works on them. If your dialect isn't in the list, you should try building lsof on it anyway.

Lsof version 4 predecessors, versions 2 and 3, may support older versions of some dialects. Contact me via e-mail at <abe@purdue.edu> if you're interested in their distributions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

2.2 What about a new port?

The 00PORTING file in the distribution gives hints on doing a port. I will consider doing a port in exchange for permanent access to a test host. I require permanent access so I can test new lsof revisions, because I will not offer distributions of dialect ports I cannot upgrade and test.

2.2.1 User-contributed Ports

Sometimes I receive contributions of ports of lsof to systems where I can't test future revisions of lsof. Hence, I don't incorporate these contributions into my lsof distribution.

However, I do make descriptions of these contributions available. You can find them in the 00INDEX and README files at:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib`

Consult the 00INDEX file in the contrib/ directory for a list of the available contributions and consult README there for information on how to obtain them.

2.3 Why isn't there an AT&T SVR4 port?

I haven't produced an AT&T SVR4 port because I haven't seen a UNIX dialect that is strictly limited to the AT&T System V, Release 4 source code. Every one I have seen is a derivative with vendor additions.

The vendor additions are significant to lsof because they affect the internal kernel structures with which lsof does business. While some vendor derivatives of SVR4 are similar, each one I have encountered so far has been different enough from its siblings to require special source code.

If you're interested in an SVR4 version of lsof, here are some existing ports you might consider:

DC/OSx (This obsolete port is only available upon special request.)

Reliant UNIX (This obsolete port is only available upon special request.)

SCO|Caldera UnixWare (This is the most likely choice.)

Solaris

2.4 Why isn't there an SGI IRIX port?

Lsof support for IRIX was terminated at lsof revision 4.36, because it had become increasingly difficult for me to obtain information on the IRIX kernel structures lsof needs to access.

At IRIX 6.5 I decided the obstacles were too large for me to overcome, and I stopped supporting lsof on IRIX. I have sources to the last revision of lsof (4.36) for IRIX, but that version of lsof does not work on IRIX 6.5 and is vulnerable to the standard I/O descriptor attack. (See the "Is lsof vulnerable to the standard I/O descriptor attack?" Q&A for more information.) Contact me to discuss obtaining those sources.

If you wish to pursue the issue, don't contact me, contact SGI. This case was opened with SGI on the subject:

Case ID: 0982584
Category: Unix
Priority: 30-Moderate Impact

Problem Summary:
kernel structure header files needed for continued lsof support

Problem Description:
Email In 07/17/98 19:09:23

2.5 Why does lsof's Configure script report "WARNING: unsupported dialect or version"?

Lsof's Configure script issues this message when it encounters a dialect or its version that lsof once supported, but no longer does. Usually I drop support for a dialect or version when I can no longer test lsof on it.

However, it's worth trying to compile and use lsof. Be sure to run the test suite. (See the answer to the "Is there a test suite?" question for information on the test suite.)

If you have problems with an unsupported dialect or version, contact me via e-mail at <abe@purdue.edu> and I may be able to help. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

3.0 Lsof Problems

3.1 Configuration Problems

3.1.1 Why can't Configure determine the UNIX dialect version?

The lsof Configure script uses UNIX shell commands, often in a command pipeline, to determine the UNIX dialect version. (Consult the dialect stanza in Configure to determine which commands are used.) If Configure can't determine the dialect version, probably one of the commands is not behaving as Configure expects.

Symptoms of the failure include Configure warning messages and incorrect version definitions in the Makefile CFLAGS.

If you suspect that the lsof Configure script is failing to determine the dialect version correctly, try running the commands from Configure stanza one at a time. That will usually reveal the source of the problem. Be particularly mindful that the PATH environment variable can cause commands to be executed from non-standard directories.

If you can't determine the source of the problem, there is a work-around. You can supply the UNIX dialect version in the LSOF_VSTR environment variable. Use Configure as a guide to forming what it expects in LSOF_VSTR. There is also some information on LSOF_VSTR in the 00XCONFIG documentation file of the lsof distribution.

3.2 Compilation Problems

3.2.1 Why does the compiler complain about missing header files?

When you use make to build lsof, the compiler may complain that it can't find header files -- e.g.,

```
$ make
(cd lib; make DEBUG="-O" CFGF="-DAIXA=0 -DAIXV=4330 \
-DLSOF_VSTR=\"4.3.3.0\"")
gcc -DAIXA=0 -DAIXV=4330 -DLSOF_VSTR="4.3.3.0" -O \
-c ckkv.c
In file included from ckkv.c:33: ../machine.h:70: \
sys/types.h: A file or directory in the path name \
does not exist. \
```

That type of complaint doesn't represent an lsof problem. It represents a problem with a missing system header file that probably should be found in /usr/include or in the system source tree.

As a first step try using `find(1)` to locate the problem header file. If it's a system header file and can't be found, here are some possible causes:

1. The file set, RPM or package containing the header files has not been installed. Instructions for doing that are specific to the UNIX dialect and beyond the scope of this document.

2. If the compiler is `gcc`, the private `gcc` header files:

- * May not have been installed;

- * May have been installed incorrectly;

- * May not have been updated properly after the last compiler or system update;

- * Ones from a previous installation may not have been removed.

A path leading to the `gcc` private header files can be found with ``gcc -v``. Consult the `gcc` documentation for instructions on proper installation of the private `gcc` header files.

3. On some dialects -- e.g., FreeBSD, NetBSD, OpenBSD -- `lsof` may need to use header files that are located in the system source tree -- `/sys` or `/usr/src/sys`, for example. Make sure the system source tree has been installed.

3.2.2 Why does `gcc` complain about the contents of header files distributed by the system's vendor?

When you use `make` to build `lsof` and `gcc` to compile it, `gcc` may complain that it finds errors in system header files

-- e.g.,

```
$ make
(cd lib; make DEBUG="-O" CFGF="-Dsolaris=80000 \
-DHASPR_GWINDOWS -m64 -DHASIPv6 -DHAS_VSOCK \
-DLSOF_VSTR=\"5.8\"")
gcc -Dsolaris=80000 -DHASPR_GWINDOWS -m64 -DHASIPv6 \
-DHAS_VSOCK -DLSOF_VSTR="5.8" -O -c dvch.c
In file included from /usr/include/sys/proc.h:31, \
from /homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
```

```
3.2.1/include/sys/user.h:267, from /usr/include/kvm.h:13, \
from ../dlsf.h:53, from ../lsof.h:172, from dvch.c:43: \
/homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
3.2.1/include/sys/task.h:59: parse error before "uint_t"
```

Errors like the above are most likely not problems in the system's header files, but in the private copies of them that were created when gcc was made or installed. Note the presence of
"../gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/3.2.1/include/..."
in the paths for user.h and task.h. It indicates both header files are gcc-specific.

To solve errors like this requires comparing the header files in the vendor's /usr/include tree to the gcc-specific ones in gcc's private gcc-lib/.../include tree. It may be necessary to regenerate gcc-specific header files, correct them or remove them. See the gcc distribution for the appropriate tools.

A possible temporary work-around is to direct gcc to use the vendor's header files instead of its temporary ones by declaring `-I/usr/include` in the compilation flags.

3.2.3 Other header file problems

Don't overlook any vendor tools that might validate the vendor header files installed on the system -- e.g., the Solaris `pkgchk` tool can be used to check the header files that were installed from the SUNWhea package.

For other header file problems contact me at <abe@purdue.edu>. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

3.3 Why doesn't lsof report full path names?

Lsof reports the full path name when it is specified as a search argument for open files that match the argument. However, if the argument is a file system mounted-on directory, and lsof finds additional path name components from the kernel name cache, it will report them.

Lsof reports path name for file system types that have path name lookup features -- e.g., some versions of AdvFS for Digital and Tru64 UNIX. The Linux /proc-based lsof reports full path names, because the Linux /proc file system provides them. Lsof on recent builds of Solaris 10 also report full

path names, because those Solaris kernels record the full path name in the vnode structure.

Otherwise, lsof uses the kernel name cache, where it exists and can be accessed, and reports some or all path name components (e.g., the sys and proc.h components of /usr/include/sys/proc.h) for these dialects:

Apple Darwin
DC/OSx
FreeBSD
HP-UX, /dev/kmem and PSTAT based
Linux, /dev/kmem-based
NetBSD
NEXTSTEP
OpenBSD
OPENSTEP
Reliant UNIX
SCO OpenServer
SCO|Caldera UnixWare
Solaris 2.x, 7, 8 and 9 (except for some VxFS versions; see the "Why doesn't Solaris lsof report VxFS path name components?" section for more information)
Solaris 10 (early builds) Tru64 UNIX

As far as I can determine, AFS path lookups don't share in kernel name cache operations, so lsof can't identify open AFS path name components. Apparently Solaris VxFS versions 4 and above don't share in kernel name cache operations, either, so lsof can't display path name components for those open files.

Since the size of the kernel name cache is limited and the cache is in constant flux, it does not always contain the names of all components in an open file's path; sometimes it contains none of them.

Lsof reports the file system directory name and whatever components of the file's path it finds in the cache, starting with the last component and working backwards through the directories that contain it. If lsof finds no path components, lsof reports the file system device name instead.

When lsof does report some path components in the NAME column, it prefixes them with the file system directory name, followed by " -- ", followed by the components -- e.g., /usr -- sys/path.h for /usr/include/sys/path.h. The

" -- " is omitted when lsof finds all the path name components of a file's name.

The PSTAT-based HP-UX lsof relies on kernel name cache contents, too, even though its information comes to lsof via pstat() function calls. Consequently, PSTAT-based HP-UX lsof won't always report full paths, but may use the " -- " partial path name notation, or may occasionally report no path name at all but just the file system mounted-on directory and device names.

Lsof can't obtain path name components from the kernel name caches of the following dialects:

AIX

Only the Linux kernel records full path names in the structures it maintains about open files; instead, most kernels convert path names to device and node number doublets and use them for subsequent file references once files have been opened.

To convert the device and node number doublet into a complete path name, lsof would have to start at the root node (root directory) of the file system on which the node resides, and search every branch for the node, building possible path names along the way. That would be a time consuming operation and require access to the raw disk device (usually implying setuid-root permission).

If the prospect of all that local disk activity doesn't concern you, think about the cost when the device is NFS-mounted.

Try using the file system mount point and node number lsof reports as parameters to find -- e.g.,

```
$ find <mount_point> -inum <node_number> -print
```

and you may get an appreciation of what a file system directory tree search would cost.

3.3.1 Why do lsof -r reports show different path names?

When you run lsof with its repeat (`-r") option, you may notice that the extent to which it reports path names for the same files may vary from cycle to cycle. That happens because other processes are making kernel calls affecting

the cache and causing entries to be removed from and added to it.

3.3.2 Why does lsof report the wrong path names?

Under some circumstances lsof may report an incorrect path name component, especially for files in a rapidly changing directory like /tmp.

In a rapidly changing directory, like /tmp, if the kernel doesn't clear the cache entry when it removes a file, a new file may be given the same keys and lead lsof to believe that the old cache entry with the same keys belongs to the new file.

Lsof tries to avoid this error by purging duplicate entries from its copy of the kernel name cache when they have the same device and inode number, but different names.

This error is less likely to occur in UNIX dialects where the keys to the name cache are node address and possibly a capability ID. The Apple Darwin, Digital UNIX, FreeBSD, HP-UX, NEXTSTEP, OPENSTEP, Solaris, Tru64 UNIX, and UnixWare dialects use node address. Apple Darwin, FreeBSD, NetBSD, OpenBSD, Tru64 UNIX, and also use a capability ID to further identify name cache entries.

3.3.3 Why doesn't lsof report path names for unlinked (rm'd) files?

When lsof gets path name components from the kernel's name cache, it does not report the path names of a file that has been unlinked from its parent directory -- e.g., deleted via rm, or the unlink() system call -- even when some process may still hold the file open; lsof reports only the file system's mounted-on directory and device. That's because path name components are removed from the kernel name cache when the file is unlinked.

Unlinked open files are sometimes used by applications for temporary, but invisible storage (i.e., ls won't show them, and no other process can open them.) However, they may occasionally consume disk space to excess and cause concern for a system administrator, who will be unable to locate them with find, ls, du, or other tools that rely on finding files by examining the directory tree.

By using lsof's +L option you can see the link count of open files -- in the NLINK column. An unlinked file will

have an NLINK value of zero. By using the option +L1 you can tell lsof to display only files whose link count is less than one (i.e., zero).

There are some UNIX dialect-specific exceptions to lsof's inability to report unlinked path names. They are described in the answer to the "When will lsof report path names for deleted files?" question.

3.3.4 Why doesn't lsof report the "correct" hard linked file path name?

When lsof reports a rightmost path name component for a file with hard links, the component may come from the kernel's name cache. Since the key which connects an open file to the kernel name cache may be the same for each differently named hard link, lsof may report only one name for all open hard-linked files. Sometimes that will be "correct" in the eye of the beholder; sometimes it will not. Remember, the file identification keys significant to the kernel are the device and node numbers, and they're the same for all the hard linked names.

3.3.5 When will lsof report path names for deleted files?

lsof will report path names for deleted files for two dialects: Linux and later builds of Solaris 10.

Deleted Linux path names are reported by default and have "(deleted)" at their ends.

The display of Solaris 10 deleted path names may be selected with the -X option. When selected they are also reported with "(deleted)" at their ends.

3.4 Why is lsof so slow?

lsof may appear to be slow if network address to host name resolution is slow. This can happen, for example, when the name server is unreachable, or when a Solaris PPP cache daemon is malfunctioning.

To see if name lookup is causing lsof to be slow, turn it off with the ``-n" option.

Port service name lookup or portmap registration lookup may also be causes of slow-down. To suppress port service name lookup, specify the ``-P" option.

Lsof doesn't usually make direct portmap calls -- only when +M is specified, or when HASPMAPENABLED is defined during lsof construction. (The lsof help panel, produced with `lsof -h` will display the default portmap registration reporting state.) The quickest first step in checking if lsof is slow because of the portmapper is to use lsof's `--M` option.

Lsof may be slow if UID to login name lookups are slow. Suppress them with `--l`.

On dialects where lsof uses the kernel name cache, try disabling its use with `--C`. (You can tell if lsof uses the kernel name cache by looking for `--C` in lsof's `--h` output.) Of course, disabling kernel name cache use will mean that lsof won't report full or partial path names, just file system and character device names.

If you're just interested in the open files of one process, try using the `--p <Process-ID>` option to limit lsof to that process. (The `--p` option may also be followed with a list of Process-IDs.)

If you're interested in including or excluding certain commands, try lsof's `-c[^]cmd` option.

If you're interested in certain Internet TCP and UDP states (e.g., ESTABLISHED) or in excluding some (e.g., CLOSE_WAIT), try lsof's `-s p:s` option. More information on it may be found in the answer to the "How are protocol state name exclusion and inclusion used?" question.

Your UNIX dialect may not support `-s p:s` and its associated performance improvements to Internet-only file processing. You can find more information on those topics in the answer to the "Why doesn't my dialect support state name exclusion and inclusion?" question.

Older AIX lsof may be slow to start because of its oslevel identity comparison. (Newer AIX lsof uses `uname(2)`.) See the "Why does AIX lsof start so slowly?" and "Why does lsof warn 'compiled for x ... y; this is z.?' sections for more information.

3.5 Why doesn't lsof's setgid or setuid permission work?

If you install lsof on an NFS file system that has been mounted with the nosuid option, lsof may not be able to

use the setgid or setuid permission you give it, complaining it can't open the kernel memory device -- e.g., /dev/kmem.

The only solution is to install lsof on a file system that doesn't inhibit setgid or setuid permission.

3.6 Does lsof have security problems?

I don't think so. However, lsof does usually start with setgid permission, and sometimes with setuid-root permission. Any program that has setgid or setuid-root permission, should always be regarded with suspicion.

Lsof drops setgid power, holding it only while it opens access to kernel memory devices (e.g., /dev/kmem, /dev/mem, /dev/swap). That allows lsof to bypass the weaker security of access(2) in favor of the stronger checks the kernel makes when it examines the right of the lsof process to open files declared with -k and -m. Lsof also restricts some device cache file naming options when it senses the process has setuid-root power.

On a few dialects lsof requires setuid-root permission during its full execution in order to access files in the /proc file system. These dialects include:

- DC/OSx 1.1 for Pyramid systems
- Reliant UNIX 5.4[34] for Pyramid systems

When lsof runs with setuid-root permission it severely restricts all file accesses it might be asked to make with its options.

The device cache file (typically .lsof_hostname in the home directory of the real user ID that executes lsof) has 0600 modes. (The suffix, hostname, is the first component of the host's name returned by gethostname(2).) However, even when lsof runs setuid-root, it makes sure the file's ownerships are changed to that of the real user and group. In addition, lsof checks the file carefully before using it (See the question "How do I disable the device cache file feature or alter its behavior?" for a description of the checks.); discards the file if it fails the scrutiny; complains about the condition of the file; then rebuilds the file.

See the 00DCACHE file of the lsof distribution for more information about device cache file handling and the risks

associated with the file.

3.7 Will lsof show remote hosts using files via NFS?

No. Remember, lsof displays open files for the processes of the host on which it runs. If the host on which lsof is running is an NFS server, the remote NFS client processes that are accessing files on the server leave no process records on the server for lsof to examine.

3.8 Why doesn't lsof report locks held on NFS files?

Generally lock information held by local processes on remote NFS files is not recorded by the UNIX dialect kernel. Hence, lsof can't report it.

One exception is some patch levels of Solaris 2.3, and all versions of Solaris 2.4 and above. Lsof for those dialects does report on locks held by local processes on remotely mounted NFS files.

3.8.1 Why does lsof report a one byte lock on byte zero as a full file lock?

When a process has a lock of length one, starting at byte zero, lsof can't distinguish it from a full file lock.

That's because most UNIX dialects represent both locks the same way in their file lock (flock or eflock) structures.

3.9 Why does lsof report different values for open files on the same file system (the automounter phenomenon)?

On UNIX dialects where file systems may be mounted by an automounter with the ``direct" type, lsof may sometimes report difference DEVICE, SIZE/OFF, INODE and NAME values when asked to report files open on the file system.

This happens because some files open on the file system -- e.g., the current directory of a shell that changed its directory to the file system as the file system's first reference -- may be characterized in the kernel with temporary automounter node information. The cd doesn't cause the file system to be mounted.

A subsequent reference to the file system -- e.g., an ls of any place in it -- will cause the file system to be mounted. Processes with files open to the mounted file system are characterized in the kernel with data that

reflects the mounted file system's parameters.

Unfortunately some kernels (e.g., some versions of Solaris 2.x) don't revisit the process that did only a change-directory for the purpose of updating the data associated with the open directory file. The file continues to be characterized with temporary automounter information until it does another directory change, even a trivial ``cd .".

Lsof will report on both reference types, when supplied the file system name as an argument, but the data lsof reports will reflect what it finds in the kernel. For the different types lsof will display different data, including different major and minor device numbers in the DEVICE column, different lengths in the SIZE/OFF column, different node numbers in the INODE column, and slightly different file system names in the NAME column.

In contrast, fuser, where available, can only report on one reference type when supplied the file system name as an argument. Usually it will report on the one that is associated with the mounted file system information. If the only reference type is the temporary automounter one, fuser will often be silent about it.

3.10 Why don't lsof and netstat output match?

Lsof and netstat output don't match because lsof reports the network information it finds in open file system objects -- e.g., socket files -- while netstat often gets its information from separate kernel tables.

The information available to netstat may describe network activities never or no longer associated with open files, but necessary for proper network state machine operation.

For example, a TCP connection in the FIN_WAIT_[12] state may no longer have an associated open file, because the connection has been closed at the application layer and is now being closed at the TCP/IP protocol layer.

3.10.1 Why can't lsof find accesses to some TCP and UDP ports?

Lsof stands for LiSt Open Files. If there is no open file connected to a TCP or UDP port, lsof won't find it. That's the most common reason why lsof doesn't find a port netstat might report open.

One reason I've found on some UNIX dialects is that their kernels set aside TCP and UDP ports for communicating with support activities, running in application layer servers -- the automounter daemons, and the NFS biod and nfsd daemons are examples. Netstat may report the ports are in use, but lsof doesn't.

Another reason is that netstat may also be able to report a port is open on a particular dialect, because it uses a source of data different from what lsof uses -- e.g., netstat might examine kernel tables or use streams messages to MIB2, while lsof relies on the information it finds in open file structures and their descendants.

Sometimes it's possible to search the data netstat and lsof use. For example, on Linux /proc/tcp and /proc/udp can be examined. There might an entry there for a particular protocol and port, but if the line on which the port appears doesn't have an inode number that matches an inode number of an open file, lsof won't be able to identify the process using the port.

This is a tough question to which there is no easy answer.

3.11 Why does lsof update the device cache file?

At the end of the lsof output you may see the message:

```
lsof: WARNING: /Homes/abe/.lsof_vic was updated.
```

In this message /Homes/abe/.lsof_vic is the path to the private device cache file for login abe. (See 00DCACHE.)

Lsof issues this message when it finds it necessary to recheck the system device directory (e.g., /dev or /devices) and rebuild the device cache file during the open file scan. Lsof may need to do these things it finds that a device directory node has changed, or if it cannot find a device in the cache.

3.12 Why doesn't lsof report state for UDP socket files?

Lsof reports UDP TPI connection state -- TS_IDLE (Idle), TS_BOUND (Bound), etc. -- for some, but not all dialects. TPI state is stream-based TCP/IP information that isn't available in many dialects.

A fairly weak general rule is if netstat(1) reports UDP

TPI state, lsof may be able to report it, too. But don't be surprised if lsof fails to report UDP TPI state for your dialect. Other factors influence lsof's ability to report UDP TPI state, including the availability of state number data in kernel structures, and state number to state name conversion data.

3.13 I am editing a file with vi; why doesn't lsof find the file?

Classic implementations of vi usually don't keep open the file being edited. (Newer ones may do so in order to maintain an advisory lock.) Instead classic vi opens the file, makes a temporary copy (usually in /tmp or /usr/tmp), and does its work in that file. When you save the file being edited from a classic vi implementation, it reopens and rewrites the file.

During a classic vi session, except for the brief periods when vi is reading or rewriting the file, lsof won't find an open reference to the file from the vi process, because there is none.

3.14 Why doesn't lsof report TCP/TPI window and queue sizes for my dialect?

Lsof only reports TCP/TPI window sizes for Solaris, because only its netstat reports them. The intent of providing TCP/TPI information in lsof NAME column output is to make it easier to match netstat output to lsof output.

In general lsof only reports queue sizes for both TCP and UDP (TPI) connections on BSD-derived UNIX dialects, where both sets of values appear in kernel socket queue structures. SYSV-derived UNIX dialects whose TCP/IP implementations are based on streams generally provide only TCP queue sizes, not UDP (TPI) ones.

While you may find that netstat on some SYSV-derived UNIX dialects with streams TCP/IP may report UDP (TPI) queue sizes, you will probably also find that the sizes are always zero -- netstat supplies a constant zero for UDP (TPI) queue sizes to make its headers align the same for TCP and UDP (TPI) connections. Solaris seems to get it right -- i.e., its netstat does not report UDP (TPI) queue sizes.

When in doubt, I chose to avoid reporting UDP (TPI) queue sizes for UNIX dialects whose netstat-reported values I knew to be a constant zero or whose origin I couldn't determine. OSR is a dialect in this category.

3.14.1 Why doesn't lsof report socket options, socket states, and TCP flags and values for my dialect?

The lsof -T argument, 'f', that selects the reporting of socket options, socket states and TCP flags was implemented at lsof revision 4.71 for the following UNIX dialects, providing the indicated information:

AIX 4.3.2 and 5.1 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Apple Darwin 7.2 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Digital UNIX and Tru64 UNIX 4.0

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

FreeBSD 4.9 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

HP-UX 11.00 (/dev/kmem-based lsof)

All socket options and values are reported. No socket states are reported. Only the TF_NODELAY TCP flag and the TF_MSS value are reported.

HP-UX 11.11 and iiv2 (PSTAT-based lsof)

All socket options and values, and socket states are reported. No TCP flags or values are reported.

Linux

No socket options and values, socket states, or TCP flags and values are reported. The support for "-Tf" could not be added to Linux, because socket options, socket states, and TCP flags and values are not available via the /proc file system.

NetBSD 1.6G and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

OpenBSD 3.4 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

OPENSTEP 4.2

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

OpenUNIX 8

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

SCO OpenServer Release 5.0.6

All socket options and values, socket states, and TCP

flags and values described in lsof(8) are reported.

Solaris 2.6, 8 and above

The socket option display is limited to BROADCAST, DEBUG, DGRAM_ERRIND, DONTRROUTE and OOBINLINE. Socket values are limited to KEEPALIVE and LINGER. No socket states are reported. The TCP DELACK, NODELAY and SENTFIN flags are reported. The TCP MSS value is reported.

UnixWare 7.1.[134]

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

3.14.2 Why doesn't lsof report the partial listen queue connection count for my dialect?

The reporting of partial listen queue connections was added to -Tf processing at lsof revision 4.76. Currently it is reported for these dialects:

AIX 4.3.2

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

AIX 5.1 and above

Partial listen queue information is available.

Apple Darwin 7.2 and above

Partial listen queue information is available.

Digital UNIX 4.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

FreeBSD 4.9 and above

Partial listen queue information is available.

HP-UX 11.00 (/dev/kmem-based lsof)

No partial listen queue information is available.

HP-UX 11.11 and iiv2 (PSTAT-based lsof)

No partial listen queue information is available.

Linux

No partial listen queue information is available.

NetBSD 1.6G and above

Partial listen queue information is available.

OpenBSD 3.4 and above

Partial listen queue information is available.

OPENSTEP 4.2

Partial listen queue information is available.

OpenUNIX 8

This dialect is no longer supported, so no attempt was made to add partial listen queue length support

for it.

SCO OpenServer Release 5.0.6

No partial listen queue information is available.

Solaris 2.6, 8 and above

Partial listen queue information is available.

Tru64 UNIX 5.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

Tru64 UNIX 5.1

Partial listen queue information is available.

UnixWare 7.1.[134]

Partial listen queue information is available.

3.15 What does "no more information" in the NAME column mean?

When lsof can find no successor structures -- a gnode, inode, socket, or vnode -- connected to the file structure of an open descriptor of a process, it reports "no more information" in the NAME column. The TYPE, DEVICE, SIZE/OFF, and INODE columns will be blank.

Because the file structure is supposed to contain a pointer to the next structure of a file's processing support, if the pointer is NUL, lsof can go no further.

Some UNIX dialects have file structures for system processes -- e.g., the sched process -- that have no successor structure pointers. The "no more information" NAME will commonly appear for these processes in lsof output.

It may also be the case that lsof has read the file structure while it is being assembled and before a successor structure pointer value has been set. The "no more information" NAME will again result.

Unless lsof output is filled with "no more information" NAME column messages, the appearance of a few should be no cause for alarm.

3.16 Why doesn't lsof find a process that ps finds?

If lsof fails to display open files for a process that ps indicates exists, there may be several reasons for the difference.

The process may be a "zombie" for which ps displays the

"(defunct)" state. In that case, the process has exited and has no open file information lsof can display. It does still have a process structure, sufficient for the needs of ps.

Another possible explanation is that kernel tables and structures may have been changing when lsof looked for the process, making lsof unable to find all relevant process structures. Try repeating the lsof request.

3.17 Why doesn't -V report a search failure?

The usual reason that -V won't report a search failure is that lsof located the search item, but was prevented from listing it by an option that doesn't participate in search failure reporting.

For example, this lsof invocation:

```
$ lsof -V -i TCP@foobar -a -d 999
```

won't report it can't find the Internet address TCP@foobar, even if there is an open file connected to that address, unless the open file also has a file descriptor number of 999 (the ``-a -d 999" options).

Compile-time options can also affect -V results in much the same way. For example, if HASSECURITY and HASNOSOCKSECURITY are defined at compile time, this lsof invocation, run by a non-root user:

```
$ lsof -V -c inetd
```

won't report that it can't find the inetd command, even if there is a process running the inetd command, because the HASSECURITY and HASNOSOCKSECURITY options prevent the listing of all but the socket files of another user, and no socket file selector (e.g., "-i") was specified.

3.18 Portmap problems

3.18.1 Why isn't a name displayed for the portmap registration?

When portmap registration reporting is enabled, any time there is a registration for a local TCP or UDP port, lsof displays it in square brackets, following the port number or service name -- e.g., ``:1234[name]" or ``:name[100083]".

The TCP or UDP port number or service number (what follows the `:') is displayed under the control of the `lsof -P` option. The registration identity is held by the portmapper and may be a name or a number, depending on how the registration's owner declared it. `lsof` reports what the port map holds and cannot derive a registration name from a registration number.

`lsof` can be compiled with registration reporting enabled or disabled by default, under the control of the `HASPMAPENABLED` `#define` (usually in `machine.h`). The `lsof` help panel (`lsof -h`) will show the default. `lsof` is distributed with reporting disabled by default.

3.18.2 How can I display only portmap registrations?

`lsof` doesn't have an option that will display only TCP or UDP ports with portmap registrations. The `+M` option only enables the reporting of registration information when Internet socket files are displayed; `+M` doesn't select the displaying of Internet socket files -- the `-i` option does that.

This simple `lsof` pipe to `grep` will do the job:

```
$ lsof -i +M | grep "["
```

This works because `-i` selects Internet socket files, `+M` enables portmap registration reporting, and only output lines with opening square brackets will have registrations.

When portmap registration reporting is enabled by default, because the `lsof` builder constructed it that way, `+M` is not necessary. (The `lsof` help panel, produced with `lsof -h` will display the default portmapper registration reporting state.) However, specifying `+M` when reporting is already enabled is acceptable, as is specifying `-M` when reporting is already disabled.

Digression: `lsof` will accept `+'` or ``-'` as a prefix to most options. (That isn't documented in the man page or help panel to reduce confusion and complexity.) The `-i` option is as acceptable as `+i`, so the above example could be written a little more tersely as:

```
$ lsof +Mi | grep "["
```

But be careful to use the ``Mi" ordering, since ``iM" implies M is an address argument to `i'.

3.18.3 Why doesn't lsof report portmap registrations for some ports?

Lsof reports portmap registrations for local TCP and UDP ports only. It identifies local ports this way:

- * The port appears in the local address section of the kernel structure that contains it.
- * The port appears in the foreign address section of a kernel structure whose local and foreign Internet addresses are the same.
- * The port appears in the foreign address section of a kernel address structure whose Internet address is INADDR_LOOPBACK (127.0.0.1).

Following these rules, lsof ignores foreign portmapped ports. That's done for reasons of efficiency and possible security prohibitions. Contacting all remote portmappers could take a long time and be blocked by network difficulties (i.e., be inefficient). Many firewalls block portmapper access for security reasons.

Lsof may occasionally ignore portmap registration information for a legitimate local port by virtue of its local port rules. This can happen when a port appears in the foreign part of its kernel structure and the local and foreign Internet addresses don't match (perhaps because they're on different interfaces), and the foreign Internet address isn't INADDR_LOOPBACK (127.0.0.1).

3.19 Why is `lsof | wc` bigger than my system's open file limit?

There is a strong temptation to count open files by piping lsof output to wc. If your purpose is to compare the number you get to some Unix system parameter that defines the number of open files your system can have, resist the temptation.

One reason is that lsof reports a number of "files" that don't occupy Unix file table space -- current working directories, root directories, jail directories, text files, library files, memory mapped files are some. Another reason is that lsof can report a file shared by more than one process that itself occupies only one file table slot.

If you want to know the number of open files that occupy file table slots, use the `+ff` option and process the `lsof` output's `FILE_ADDR` column information with standard Unix tools like `cut`, `grep`, `sed`, and `sort`.

You might also consider using `lsof`'s field output with `+ff`, selecting the file struct address with `-FF`, and processing the output with an AWK or Perl script. See the `list_fields.awk`, `list_fields.perl`, and `shared.perl5` scripts in the `scripts/` subdirectory of the `lsof` distribution for hints on file struct post-processing filters.

3.20 Why doesn't `lsof` report file offset (position)?

`lsof` won't report a file offset (position) value if the `-s` option has been specified, or if the dialect doesn't support the displaying of file offset (position).

That `lsof` is reporting only file size is indicated by the fact that the appropriate column header says `SIZE` instead of `SIZE/OFF`.

If `lsof` doesn't support the displaying of file offset (position) -- e.g., for Linux /proc-based `lsof` -- the `-h` or `-?` output panel won't list the `-o` option.

Sometimes the availability of file offset information depends on the dialect's kernel. This is particularly true for socket file offsets.

Maintenance of offsets for pseudo-terminal devices varies by UNIX dialect and is related to how the dialect kernel implements pseudo-terminal support. Kernels like AIX, for example, that short-circuit the transfer of data between socket and pseudo devices to reduce TCP/IP daemon interrupt rates won't advance offsets in the TCP/IP daemon socket files. Instead they will advance offsets in the open standard I/O files of the shell child process where the pseudo-terminal devices are used.

When in doubt about the behavior of `lsof` in reporting file offset information, do some carefully measured experiments, consult the `lsof` sources, or contact me at [<abe@purdue.edu>](mailto:abe@purdue.edu) to discuss the matter. Please follow the reporting guidelines in the "How do I report an `lsof` bug?" section of this FAQ.

3.20.1 What does `lsof` report for size when the file doesn't really have

one?

When a file has no true size -- e.g., it's a socket, a FIFO, or a pipe -- lsof tries to report the information it finds in the kernel that describes the contents of associated kernel buffers.

Thus, for example, size for most TCP/IP files is socket buffer size. The size of the socket read buffer is reported for read-only files; the size of the write buffer for write-only files; and the sum of the buffers sizes for read-write files.

3.21 Problems with path name arguments

3.21.1 How do I ask lsof to search a file system?

You can ask lsof to search for all open files on a file system by specifying its mounted path name as an lsof argument -- e.g.,

```
$ lsof /
```

Output of the mount command will show file system mounted path names. It will also show the mounted-on device path for the file system.

If the mounted-on device is a block device (the permission field in output of `ls -l <device>` starts with a ``b/`), you can specify it's name, too -- e.g.,

```
$ lsof /dev/sd0a
```

If the mounted-on device isn't a block device -- for example, some UNIX dialects call a CD-ROM device a character device (ls output starts with a ``c'`) -- you can force lsof to assume that the specified device names a file system with the `+f` option -- e.g.,

```
$ lsof +f -- /dev/sd0a
```

(Note: you must use ```--`" after `+f` or `-f` if a file name follows immediately, because `+f` and `-f` can be followed by characters that specify flag output selections.)

When you use `+f` and lsof can't match the device to a file system, lsof will issue a complaint.

The `+f` option may be used in some dialects to ask `lsof` to search for an NFS file system by its server name and server mount point. If the mount application reports an NFS file system mounted-on value that way, then this sample `lsof` request should work.

```
$ lsof +f -- fleet:/home/fleet/u5
```

Finally, you can use `-f` if you don't want a mounted file system path name to be considered a request to report all open files on the file system. This is useful when you want to know if anyone is using the file system's mounted path name. This example directs `lsof` to report on open access to the `/` directory, including when it's being used as a current working or root directory.

```
$ lsof -f -- /
```

The `lsof -f` option performs the same function as `-f` does in some fuser implementations. However, since the `lsof -c` option was chosen for another purpose before the `-f` option was added to `lsof`, `+f` was selected as the analogue to the fuser `-c` option. (Sorry for the potential confusion.)

3.21.2 Why doesn't `lsof` find all the open files in a file system?

`lsof` may not find all the open files in a file system for several reasons.

First, some processes with files open on the file system may have been changing status when `lsof` examined the process table, and `lsof` "missed" them. Remember, the kernel changes much faster than `lsof` can respond to the changes.

Second, be sure you have specified the file system correctly. Perhaps you specified a file instead. You can use `lsof's -V` option to have `lsof` report in detail on what it couldn't find. Make sure the report for the file system you specified says "file system." Here's some `-V` output:

```
$ /lsof -V /tmp ./lsof.h ./lsof
COMMAND PID USER  FD  TYPE DEVICE SIZE/OFF INODE NAME
lsof   2688  abe  txt  VREG 18,1,7 1428583 226641 ./lsof
lsof   2689  abe  txt  VREG 18,1,7 1428583 226641 ./lsof
lsof: no file use located: ./lsof.h
```

You can also use `lsof's +f` option to force it to consider a path name as a file system. If `lsof` can't find a file

system by the specified name, it will issue a complaint --
e.g.,

```
$ lsof +f -- /usr
lsof: not a file system: /usr
```

(/usr is a directory in the / file system.)

3.21.3 Why does the lsof exit code report it didn't find open files when some files were listed?

Sometimes lsof will list some open files, yet return a non-zero exit code, suggesting it hasn't found all the specified files.

The first thing you should when you suspect lsof is incorrect is to repeat the request, adding the -V option. In the resulting report you may find that your file system specification really wasn't a file system specification, just a file specification.

Finally, if you specify two files or two file systems twice, lsof will credit all matches to the first of the two and believe that there were no matches for the second. It's possible to specify a single file system twice with different path names by using both its mounted directory path name and mounted-one device name.

```
$ lsof +f -V spcuna:/sysprog /sysprog
COMMAND PID USER  FD  TYPE DEVICE SIZE/OFF INODE NAME
ksh     11092 abe  cwd  VDIR 39,0,1  1536 226562 /sysprog
(spcuna:/sysprog)
...
lsof: no file system use located: spcuna:/sysprog
```

All matches were credited to /sysprog; none to spcuna:/sysprog.

3.21.4 Why won't lsof find all the open files in a directory?

When you give lsof a simple directory path name argument (not a file system mounted-on name), you are asking it to search for processes that have the directory open as a file, or as a process-specific directory -- e.g., root or current working directory.

If you want to list instances of open files inside the directory, you need to specify the individual path names of those files, or use the lsof +D and +d options.

See the answer to the question "Why are the +D and +d options so slow?" before you use +D or +d casually.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

3.21.5 Why are the +D and +d options so slow?

The +D and +d options cause lsof to build a path name search list for a specified directory. +D causes lsof to descend the directory to its furthest subdirectory, while +d restricts it to the top level. In both cases, the specified directory itself is included in the search list. In both symbolic links are ignored.

Building such a search list can take considerable time, especially when the specified directory contains many files and subdirectories -- lsof must call the system readlink() and stat() functions for each file and directory. Storing the search list can cause lsof to use more than its normal amount of dynamic memory -- each file recorded in the search list consumes dynamic memory for its path name, characteristics, and search linkages. Using the list means lsof must search it for every open file in the system.

Building the search list for a directory specified on some file systems can be slow -- e.g., for an NFS directory with many files. Some file systems have special logging features that can introduce additional delays to the building of the search list -- e.g., NFS logging, or logging on a Solaris UFS file system. The bottom line is that slow search list construction may not be so much an lsof problem as a file system problem. (Hint: if you're using Solaris UFS logging, consider specifying the "logging,noatime" option pair to reduce the number of atime writes to the UFS logging queue and disk.)

A somewhat risky way to speed up lsof's building of the search list is to use lsof's ``-O" option. It forces lsof to do all system calls needed to build the search list directly, rather than in a child process. While direct system calls are much faster, they can block in the kernel -- e.g., when an NFS server stops responding -- stopping lsof until the kernel operation unblocks.

As an example of the load +D can impose, consider that an

`ls -lR` on a lightly loaded NeXT '040 cube with a 1GB root file system disk took 4+ minutes of real time. It also generated several hundred error messages about files and directories the `ls -lR` process didn't have permission to access with `stat(2)`.

The bottom line is that `+D` and `+d` should be used cautiously. `+D` is more costly than `+d` for deeply nested directory trees, because of the full directory descent it causes. So use `+d` where possible. And you might need to consider the performance of the file system that holds the directory you name with `+d` or `+D`.

In view of these warnings, when is it appropriate to use `+D` or `+d`? Probably the most appropriate time is when you would specify the directory's contents to `ls -lR` with a shell globbing construct -- e.g., ``ls -lR *``. If that's what you need to do, ``ls -lR .`` is probably more efficient than having the shell produce a directory list, form it into an argument vector, and pass the vector to `ls -lR` for it to unravel.

See the answer to the question "Why do the `+D` and `+d` options produce warning messages?" for an explanation of some process authority limitations of `+D` and `+d`.

3.21.6 Why do the `+D` and `+d` options produce warning messages?

`+D` and `+d` option processing is limited by the authority of the `ls -lR` process -- i.e., `ls -lR` can only examine (with `lstat(2)` and `stat(2)`) files the owner of the process can access.

If the ownership, group membership, or permissions of the specified directory, file within it, or directory within it prevents the owner of the `ls -lR` process from using `lstat(2)` or `stat(2)` on it, `ls -lR` will issue a warning message, naming the path and giving the system's (`lstat(2)`'s or `stat(2)`'s) reason (errno explanation text) for refusing access.

As an example, assume user `abc` has a subdirectory in `/tmp`, owned by `abc` and readable, writable and searchable by only its owner. If user `def` asks `ls -lR` to search for all `/tmp` references with `+D` or `+d`, `ls -lR` will be unable to `lstat(2)` or `stat(2)` anything in `abc`'s private subdirectory, and will issue an appropriate warning.

`ls -lR` warnings can usually be suppressed with the `-w` option.

However, using `-w` with `+D` or `+d` means that there will be no indication why `lsof` couldn't find an open reference to a restricted directory or something contained in it.

Hint: if you need to use `+D` or `+d` and avoid authority warnings, and if you have super-user power, `su` and use `lsof` with `+D` or `+d` as root.

3.22 Why can't my C compiler find the `rpcent` structure definition?

When you try to compile `lsof` your compiler may complain that the `rpcent` structure is undefined. The complaints may look like this:

```
>print.c: In function `fill_portmap':  
>print.c:213: dereferencing pointer to incomplete type  
>...
```

The most likely cause is that someone has allowed a BIND installation to update `/usr/include/netdb.h` (or perhaps `/usr/include/rpc/netdb.h`), removing the `rpcent` structure definition that `lsof` expects to find there.

Only Solaris has an automatic work-around. (See `dlsof.h` in `dialects/sun.`) The Solaris work-around succeeds because there is another header file, `<rpc/rpcent.h>`, with the `rpcent` structure definition, and there is a Solaris C pre-processor test that can tell when the BIND `<netdb.h>` is in place and hence `<rpc/rpcent.h>` must be included.

Doubtlessly there are similar work-arounds possible in other UNIX dialects whose header files have been "touched" by BIND, but in general I recommend restoration of the vendor's `<netdb.h>` and any other header files BIND might have replaced. (I think BIND replaces `<resolv.h>`, `<sys/bitypes.h>`, `<sys/cdefs.h>` -- and maybe others.)

3.23 Why doesn't `lsof` report fully on file "foo" on UNIX dialect "bar?"

`lsof` sometimes won't report much information on a given file, or may even report an error message in its `NAME` column. That's usually because the file is of a special type -- e.g., in a file system specific to the UNIX dialect -- and I haven't used a system where the file appeared during my testing.

If you encounter such a situation, send me e-mail at

<abe@purdue.edu> and we may be able to devise an addition to lsof that will report on the file in question. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

3.24 Why do I get a complaint when I execute lsof that some library file can't be found?

On systems where the LIBPATH (or the equivalent) environment variable is used to record the library search path in executable files when they are built, an incorrect value may make it impossible for the system to find the shared libraries needed to load lsof for execution.

This may be particularly true on systems like AIX $\geq 4.1.4$, where the lsof Makefile takes the precautionary step of using the `-bnolibpath` loader flag to insure that the path to the private static lsof library is not recorded in the lsof binary. Should LIBPATH be invalid when lsof is built, it will be recorded in the lsof binary as the default library path search order and lead to an inability to find libraries when lsof is executed.

So, if you get missing library complaints when you try to execute lsof, check LIBPATH, or whatever environment variable is used on your system to define library search order in executable files. Use the tools at your disposal to look at the library paths recorded in the lsof binary -- e.g., `chatr` on HP-UX, `dump` on AIX, `ldd` on Solaris.

Make sure, too, that when the correct library search path has been recorded in the executable file, the required library files exist at one or more of the search paths.

3.25 Why does lsof complain it can't open files?

When lsof begins execution, unless it has been asked to report only help or version information, typically it will attempt to access kernel memory and symbol files -- e.g., `/unix`, `/dev/kmem`. Even though lsof needs only permission to open these files for reading, read access to them might be restricted by ownerships and permission modes.

So the first step to diagnosing lsof problems with opening files is to use `ls(1)` to examine the ownerships and permission

modes of the files that lsof wants to open. You may find that lsof needs to be installed with some type of special ownership or permission modes to enable it to open the necessary files for reading. See the "Installing Lsof" section of OOREADME for more information.

3.26 Why does lsof warn "compiled for x ... y; this is z."?

Unless warnings are suppressed (with `-w`) or the kernel identity check symbol (`HASKERNIDCK`) definition has been deleted, all but one lsof dialect version (exception: /proc-based Linux lsof) compare the identity of the running kernel to that of the one for which lsof was constructed. If the identities don't match, lsof issues a warning like this:

```
lsof: WARNING: compiled for Solaris release 5.7; this is 5.6.
```

Two kernel identity differences can generate this warning -- the version number and the release number.

Build and running identity differences are usually significant, because they usually indicate kernels whose structures are different -- kernel structures commonly change at dialect version releases. Since lsof reads data from the kernel in the form of structures, it is sensitive to changes in them. The general rule is that an lsof compiled for one UNIX dialect version will not work correctly when run on a different version.

There are three work-arounds: 1) use `-w` to suppress the warning -- and risk missing other warnings; 2) permanently disable the identity check by deleting the definition of `HASKERNIDCK` in the dialect's `machine.h` header file -- with the same risk; or 3) rebuild lsof on the system where it is to be run. (Deleting `HASKERNIDCK` can be done with the `Customize` script or by editing `machine.h`.)

Generally checking kernel identity is a quick operation for lsof. However, it is potentially slow under AIX, where lsof must run `/usr/bin/oslevel`. To speed up lsof, use `-w` to suppress the `/usr/bin/oslevel` test. See "Why does AIX lsof start so slowly?" for more information.

3.27 How can I disable the kernel identity check?

The kernel identity check is controlled by the `HASKERNIDCK` definition. When it is defined, most dialects (exclusion:

/proc-based Linux lsof) will compare the build-time kernel identity with the run-time one.

To disable the kernel identity check, disable the HASKERNIDCK definition in the dialect's machine.h header file. The Customize script can be used to do that in its section about the kernel identity check.

Caution: while disabling the kernel identity check may result in smaller lsof startup overhead, it comes with the risk of executing an lsof that may produce warning messages, error messages, incorrect output, or no output at all.

3.28 Why don't ps(1) and lsof agree on the owner of a process?

Generally the user ID lsof reports in its USER column is the process effective user ID, as found in the process structure. Sometimes that may not agree with what ps(1) reports for the same process.

There are sundry reasons for the difference. Sometimes ps(1) uses a different source for process information, e.g., the /proc file system or the psinfo structure. Sometimes the kernel is lax or confused (e.g., Solaris 2.5.1) about what ID to report as the effective user ID. Sometimes the system carries only one user ID in its process structure (some BSD derivatives), leaving lsof no choice.

The differences between lsof and ps(1) user identifications should be small and normally it will be apparent that the confusion is over a process whose application has changed to an effective user ID different from the real one.

3.29 Why doesn't lsof find an open socket file whose connection state is past CLOSE_WAIT?

TCP/IP connections in states past CLOSE_WAIT -- e.g., FIN_WAIT_1, CLOSING, LAST_ACK, FIN_WAIT_2, and TIME_WAIT -- don't always have open files associated with them. When they don't, lsof can't identify them. When the connection state advances from CLOSE_WAIT, sometimes the open file associated with the connection is deleted.

3.30 Why don't machine.h definitions work when the surrounding comments are removed?

The machine.h header files in dialect subdirectories have some commented-out definitions like:

```
/* #define HASSYSDC "/your/choice/of/path */
```

You can't simply remove the comments and expect the definition to work. That's intended to make you think about what value you are assigning to the symbol. The assigned value might have a system-specific convention. HASSYSDC, for example, might be `/var/db/lsof.dc` for FreeBSD, but it might be `/var/adm/lsof.dc` for Solaris.

Symbols defined in the `lsof` documentation are described in `00PORTING`, other `machine.h` comments, and other `lsof` documentation files. HASSYSDC, for example, is discussed in `00DCACHE`. When comments and documentation don't suffice, consult the source code for hints on how the symbol is used.

3.31 What do "can't read inpcb at 0x...", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE", etc. mean?

Sometimes `lsof` will report "can't read inpcb at 0x00000000", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE" or a similar message in the NAME column for open TCP socket files. These messages mean the file's socket structure lacks a pointer to the Internet Protocol Control Block (inpcb) where `lsof` expects to find connection addresses -- local and foreign ports, local and foreign IP addresses. The socket file has probably been submitted to the `shutdown(2)` function for processing.

In some implementations `lsof` issues the "no PCB, CANTSENDMORE, CANTRCVMORE" message, which tries to explain the absence of a protocol control block by showing the socket state settings that have been made by the `shutdown(2)` function.

If a non-zero address follows the "0x" in the "can't read inpcb" message, it means `lsof` couldn't read inpcb contents from the indicated address in kernel memory.

3.32 What do the "unknown file system type" warnings mean?

`lsof` may report a message similar to"

```
unknown file system type, v_op: 0x10472f10
```

in the NAME column for some files.

This means that `lsof` has encountered a vnode for the file

whose operation switch address (from v_op) references a file system type for which there is no support in lsof.

After lsof identifies the file system type, it uses pre-compiled code to locate the file system specific node for the file where lsof finds information like file size, device number, node number, etc.

To get some idea of what the file system type might be, use nm on your kernel symbol file to locate the symbol name that corresponds to the v_op address -- e.g., on Solaris do:

```
$ nm -x /dev/ksyms | grep 0x10472f10
0x10472f10 ... |file_system_name_vnodeops
```

Where "file_system_name" is the clue to the unsupported file system.

Lsof doesn't use the v_op address to identify file system types on all dialects. Sometimes it uses an index number it finds in the vnode. It will translate that symbol to a short name in the warning message -- e.g., "nfs3" -- if possible.

3.33 Installation

3.33.1 How do I install lsof?

There is no "standard" way to install lsof. Too much depends on local conditions for me to be able to provide working install rules in the lsof make files. (The skeleton install rules you will find just give "hints.") See the "Installing Lsof" section of 00README for a fuller explanation.

To install lsof you will need to consider these questions:

- * Who should be able to use lsof? (See HASSECURITY and HASNOSOCKSECURITY in the "Security" section of 00README.)
- * Where should lsof be installed? This is a decision mostly dictated by local conditions. Somewhere in /usr/local -- etc/ or sbin/ -- is a common choice.
- * What permissions should I give the lsof executable? The answer to this varies by dialect. The make files have install rules that give hints. The "Installing Lsof" section of 00README gives information, too.

* What if I want to install lsof in a shared file system for machines that require different lsof configurations? See the next question and answer, "How do I install a common lsof when I have machines that need differently constructed lsof binaries?"

3.33.2 How do I install a common lsof when I have machines that need differently constructed lsof binaries?

A dilemma that faces some system administrators when they install lsof in a shared file system -- e.g., NFS -- is that they must have different lsof executables for different systems.

The answer is to build an lsof wrapper script that is executed in place of lsof. The script can use system commands to determine which lsof binary should be executed.

Consider this example. You have HP-UX machines with 32 and 64 bit kernels that share the /usr/local/sbin directory where you want to install lsof. Consequently, on each system you must use a different lsof executable, built for the system's bit size. (That's because lsof reads kernel structures, sized by the kernel's bit size.)

One answer is to install three things in /usr/local/sbin: 1) a 32 bit lsof as lsof32; 2) a 64 bit lsof as lsof64; and 3) an lsof script. The script might look like this one, based on work by Amir J. Katz:

```
#!/bin/sh
x=`/usr/bin/getconf KERNEL_BITS` # returns 32 or 64
if /usr/bin/test "X$x" = "X32"
then
  lsof32 $*
else
  if /usr/bin/test "X$x" = "X64"
  then
    lsof64 $*
  else
    echo "Can't determine which lsof executable to use;"
    echo "getconf KERNEL_BITS says: $x"
  fi
fi
```

Solaris users should consult "How do I install lsof for Solaris 7, 8 or 9?" for information on a similar trick

using the Solaris isaexec command.

Users of other dialects might be able to use a command like `uname(1)` that can identify a distinguishing feature of the system to be incorporated in pre-installed lsof executable names. For example, use ``uname -r`` and install binaries with suffixes that match ``uname -r`` output.

3.34 Why do lsof 4.53 and above reject device cache files built by earlier lsof revisions?

When lsof revisions 4.53 run and encounter a device cache file built by an earlier revision, it will reject the file and build a new one. The rejection will be advertised with these messages:

```
lsof: WARNING: no /dev device in <name>: 2 sections
...
lsof: WARNING: created device cache file: <name>
```

This happens because the header line of the device cache file was changed at revision 4.53 to contain the number of the device on which the device directory resides. The old device cache file header line -- the "2 sections" line in the above warning message, now reads "2 sections, dev=600".

This is not a serious problem, since lsof automatically rebuilds the device cache file with the correct header line.

3.35 What do "like block special" and "like character special" mean in the NAME column?

When lsof comes across an open block or character file whose device, raw device and inode place it somewhere other than /dev (or /devices), lsof doesn't report the /dev (or /devices) name in the NAME column. Instead lsof reports the file system name and device or path name in the NAME column and parenthetically adds "like block special <path>" or "like character special <path>".

The value for <path> will point to a block or character device in /dev (or /devices) whose raw device number matches that of the open file being reported, but whose device number or node number (or both) don't match.

Such an open file is connected to a device node that has been created in a directory other than /dev (or /devices.)

See `mknod(8)` for information on how such nodes are created.
(Generally one needs root power to create device nodes with `mknod`.)

3.36 Why does an `lsof` make fail because of undefined symbols?

When `lsof` is compiled via the `make` step and the final load step fails because of missing symbols, the problem may not be `lsof`. The problem may be that `ld`, called by the compiler as part of the `make` step, can't find some library that `lsof` needs.

First check the last compiler line of the make operation -- e.g., the last line with `cc` or `gcc` in it before the undefined symbol report -- for loader arguments, i.e., ones beginning with `-l`. Except for `-llsof` the rest name system libraries. (`-L./lib` precedes `-llsof` to tell the loader its location.)

Check that all the named system libraries exist. Look in `/lib` and `/usr/lib` as a start, but that may not be the only place system libraries live. Consult your dialect's documentation, e.g., the compiler and loader man pages, for other possible locations.

If some system library doesn't exist, that may mean it was never installed or was removed. You'll have to re-install the missing library.

You may find that all the system libraries `lsof` uses exist. Your next step might be to use `nm` and `grep` to see if any of them contain the undefined symbols.

```
$ nm library | grep symbol
```

If the undefined symbol exists in some library named by the `lsof` make step, then you might have a problem with some environment variable that controls the load step. The most common is `LD_LIBRARY_PATH`. It may have a setting that causes `ld` to ignore a directory containing a library `lsof` names. If this is the case, try unsetting `LD_LIBRARY_PATH` in the environment of the `ld` process -- e.g., do:

```
$ unset LD_LIBRARY_PATH  
or  
% unsetenv LD_LIBRARY_PATH
```

Consult your `ld` man page for other environment variables

that might affect library searching -- e.g., LIBPATH, LPATH, SHLIB_PATH, etc.

If the undefined function doesn't exist in any libraries lsof names, check other libraries. See if the function has a man page that names its library. If the latter is true, please let me know, because that is an lsof problem I need to fix.

If none of these solutions work for you, send me some documentation via e-mail at <abe@purdue.edu>. Include ``uname -a`` output, the output of the lsof ``Configure ...`` and ``make`` steps, and the contents of the environment in force when the ``make`` step was executed -- e.g., ``env`` or ``printenv`` output. If you've located the libraries lsof names, send me that information, too. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

3.37 Command Regular Expressions (REs)

3.37.1 What are basic and extended regular expressions?

Lsof's ```-c`` option allows the specification of regular expressions (REs), enclosed in two slash (`/`) characters and followed by these modifiers:

- `b` the RE is a basic RE.
- `i` ignore case.
- `x` the RE is an extended RE (the default).

Note: the characters of the regular expression may need to be quoted to prevent their expansion by the shell.

Example: this RE is an extended RE that matches exactly four characters, whose third may be an upper (`'O'`) or lower case (`'o'`) oh:

```
-c /^..o.$/i
```

For simplicity's sake, an RE that is acceptable to `egrep(1)` is usually called an extended RE.

REs suitable for the old line editor, `ed(1)`, are often called basic REs (and sometimes also called obsolete).

These are some ways basic REs usually differ from extended REs. (There are other differences.)

- * `]`, `+`, `?`, `{`, and `}` are ordinary characters.
- * `^` is an ordinary character except at the beginning of the RE.
- * `$` is an ordinary character except at the end of the RE.
- * `*` is an ordinary character if it appears at the beginning of the RE.

For more information on REs and the distinction between basic and extended REs, consult your dialect's man pages for `ed(1)`, `egrep(1)`, `sed(1)`, and possibly `regex(5)` or `regex(7)`.

3.37.2 Why can't I put a slash in a command regular expression?

Since a UNIX command name is the last part of a path to the command's executable, the `lsof` command regular expression (RE) syntax uses slash (`/`) to mark the beginning and end of an RE. Slash may not appear in the RE and the `\` back-slash escape is ineffective for "hiding" it.

More likely than not, if you try to put a slash in an `lsof` command RE, you'll get this response:

```
$ lsof -s./\// ...
lsof: invalid regexp modifier: /
```

`lsof` is complaining the the first character it found after the second slash isn't an `lsof` command RE modifier -- `'b'`, `'i'`, or `'x'`.

3.37.3 Why does `lsof` say my command regular expression wasn't found?

When you use both forms of `lsof`'s `-c` option -- ```-c <command>''` and ```-c /RE/[m]''` -- and ask that `lsof` do a verbose search (```-V''`), you may be surprised that `lsof` will say that the regular expression wasn't found.

This can happen if the ```-c <command>''` form matches first, because then the ```-c /RE/[m]''` test will never have been applied. For example:

```
$ ./lsof -clsof -c/^..o.$/ -V -adcwd
COMMAND PID USER  FD  TYPE DEVICE SIZE/OFF  NODE NAME
lsof   7850 abe  cwd  VDIR  6,0  2048 96442 / (/dev/sd0a)
```

lsof: no command found for regex: ^..o.\$

The `--clsof` option matched first, so the `--c/^..o.$/` option wasn't tested.

3.38 Why doesn't lsof report on shared memory segments?

lsof reports on shared memory segments only if they're associated with an open file. That's consistent with lsof's mission -- to list Open Files. Shared memory segments with no file associations aren't open files.

That's not to say that a report on shared memory segments and their associated processes wouldn't be useful. But it calls for a new tool, not more baggage for lsof.

3.39 Why does lsof report two instances of itself?

When you ask lsof to report all open files and it has permission to do so, you may see two lsof processes in the output. The processes are connected via pipes -- e.g., here's an HP-UX 11 example.

```
COMMAND  PID USER  FD  TYPE  DEVICE ...
...
lsof    29450  abe   7w  PIPE 0x48732408 ...
lsof    29450  abe   8r  PIPE 0x48970808 ...
...
lsof    29451  abe   6r  PIPE 0x48732408 ...
lsof    29451  abe   9w  PIPE 0x48970808 ...
```

The first process will usually be the lsof you initiated; the second, an lsof child process that is used to isolate its parent process from kernel functions that can block -- e.g., `readlink()` or `stat()`.

Information to and from the kernel functions is exchanged via the two pipes. When the parent process detects that the child process has become blocked, it attempts to kill the child. Depending on the UNIX dialect that may succeed or fail, but the parent won't be blocked in any event.

See the "BLOCKS AND TIMEOUTS" and "AVOIDING KERNEL BLOCKS" sections of the lsof man page for more information on why the child process is used and how you can specify lsof options to avoid it. (Caution: that may be risky.)

3.40 Why does lsof report '\n' in device cache file error messages?

Lsof revisions prior to 4.58 may report '\n' in error messages it delivers about problems in the device cache file -- e.g.,

```
lsof: WARNING: no ...: 4 sections\n
```

That's deliberately done to show the exact contents of the device cache file line about which lsof is complaining, including its terminating NL (New Line) '\n' character. In the above example the line in the device cache file causing the lsof complaint contains "4 sections" and ends with a '\n'.

At revision 4.58 and above, device cache error messages like the one in the above example have been changed to read:

```
lsof: WARNING: no ...: line "4 sections"
```

The terminal '\n' is no longer reported, the line contents are enclosed in double quote marks (""), and the word "line" has been added as a prefix to denote that what follows is a line from the device cache file.

3.41 Kernel Symbol and Address Problems

3.41.1 What does "lsof: WARNING: name cache hash size length error: 0" mean?

When run on some systems, lsof may issue this warning:

```
lsof: WARNING: name cache hash size length error: 0
```

That is an example from a FreeBSD system where lsof reads the kernel's `_nchash` variable and finds its value is zero.

Similar warnings include:

```
WARNING: kernel name cache size:
```

```
WARNING: can't read kernel's name cache:
```

```
WARNING: no name cache address
```

```
WARNING: name cache hash size length error:
```

```
WARNING: unusable name cache size:
```

These warnings are issued when lsof is attempting to read the kernel's name cache information. They are usually the result of a mis-match between the addresses for kernel

symbols lsof gets via nlist(2) and the addresses in use by the kernel.

Lsof usually gets kernel symbol addresses from what it believes to be the kernel boot file. In FreeBSD, for example, that's the path returned by getbootfile(3), usually /kernel. The boot file can have other names in other UNIX dialects -- /unix, /vmunix, /bsd, /netbsd, /mach, /stand/vmunix, etc.

Lsof will get incorrect (mismatched) addresses from the boot file if it has been replaced by a newer one which hasn't yet been booted -- e.g., if this is done in FreeBSD:

```
# mv /kernel /kernel.OLD
# mv /kernel.NEW /kernel
```

Until the FreeBSD system is rebooted, the booted kernel is /kernel.OLD, but getbootfile() says it is /kernel. If symbol addresses important to lsof in /kernel.OLD and /kernel don't match, the lsof WARNING messages result.

3.41.2 Why does lsof produce "garbage" output?

Kernel name cache warnings may not be the only sign that lsof is using incorrect symbol addresses to read kernel values. If there's no reasonable test lsof can make on what it reads from the kernel, it may issue other warnings or even report nonsensical results.

The warnings may appear on STDERR, such as:

```
lsof: can't read proc table info
```

Or the warnings may appear in the NAME column as messages saying lsof can't read or interpret some kernel structure -- e.g.,

```
... NAME
... can't read file struct from 0x12345
```

One possible work-around is to point lsof's kernel symbol address gathering at the proper boot file. That can be done with lsof's -k option -- e.g.,

```
$ lsof -k /kernel.OLD
```

The best work-around is to make sure the standard boot file

is properly sited -- e.g., if you've moved a new /kernel in place, boot it.

3.42 Why does lsof report open files when run as super user that it doesn't report when run with lesser privileges?

The most likely cause is that the HASSECURITY option was selected when the lsof executable was built.

If HASSECURITY is defined when lsof is built, and lsof is run with the privileges of a non-ROOT user, it will only list open files belonging to the user. The same lsof executable, when run with root user privileges, will list all open files.

However, if HASSECURITY and HASNOSOCKSECURITY are both defined when lsof is built, lsof will list open files belonging to the user and will also list anyone else's open socket files, provided their listing is selected with the "-i" option.

So first ask yourself if the process whose open files lsof won't list belong to a user other than the one under which you're running lsof, and are not open socket files. If either is true, use lsof's help (-h or -?) option and look for a line near the bottom of the help panel that says:

```
"... can list all files..."
```

If the leading "..." says "Only root" then HASSECURITY was defined when lsof was built. If the trailing "..." says ", but anyone can list socket files" then HASNOSOCKSECURITY was also defined.

Should you want an lsof not built with HASSECURITY defined, rerun the lsof Configure script. If you let Configure do customization, make sure you answer 'n' when it asks if you want to enable HASSECURITY and HASNOSOCKSECURITY. If you don't need to do customization, you can rebuild lsof with the "-n" option to Configure. Here's an example of such a rebuild sequence:

```
$ Configure -clean
$ Configure -n <dialect-abbreviation>
$ make
```

More information on the HASSECURITY and HASNOSOCKSECURITY options may be found in the "Security" section of the

00README file of the lsof distribution.

3.43 Test Suite Problems

3.43.1 Errors all tests can report:

3.43.1.1 Why do tests complain "ERROR!!! can't execute ../lsof"?

All tests in the test suite expect an executable lsof file to exist in the tests parent directory, ../lsof.

If there's none there, the tests/Makefile has a rule to make it, but there are probably circumstances where that rule may fail.

The work-around is to re-Configure and re-make lsof, then run the test suite.

3.43.1.2 Why do tests complain "ERROR!!! can't find ..." a file?

Many tests create (or use from a supplied environment variable path) a test file and use lsof to find it. When lsof can't find the file, the tests report the error with messages of the form:

```
ERROR!!! can't find ... : <some file path>
```

or

```
ERROR!!! lsof couldn't find ...
```

These type of error messages mean that the lsof field output delivered to the test didn't contain a file that the test could identify as the one it intended lsof to find. It might also mean that the process information -- command name, PID or parent PID -- didn't match what the test expected.

This could imply a bug in the test or a bug in lsof. Try using lsof to find a known file that is open. For example, while in the tests sub-directory, do this:

```
$ sleep 30 < Makefile
$ ../lsof Makefile
```

If lsof doesn't report that Makefile is open, then the fault may be with lsof. If lsof reports the file is open, search further in the test code for the failure cause.

3.43.1.3 Why do some tests fail to compile?

If a test suite program fails to compile, it may be because I've never had an opportunity to compile the test on the particular UNIX version you are using.

See Appendix B in 00TEST for a list of the UNIX dialects where the test suite has been validate.

3.43.1.4 Why do some tests always fail?

There are several tests in the optional group that have conflicting or special requirements:

LTbigf needs a dialect and file system that support large files.

LTlock won't work if the tests/ sub-directory is on an NFS file system.

LTnfs won't work if the tests/ sub-directory is not on an NFS file system.

So for two tests in particular, LTlock and LTnfs, one will generally fail.

Some failing tests can be run successfully by supplying to them a path to the appropriate type of file system with the -p option.

3.43.1.5 Why does the test suite say it hasn't been validated on my dialect?

When you use the default rule of the test suite's Makefile, it may issue this complaint:

```
$ cd tests
$ make
!!!WARNING!!!
```

This dialect or its particular version may not have been validated with the lsof test suite. Consequently some tests may fail or may not even compile.

```
!!!WARNING!!!
```

You are then given the opportunity to answer 'y' to have the test suite operation continue.

This message means that the tests/TestDB file in the tests sub-directory doesn't show that the test suite has been run with the combination of compiler flags found in tests/config.cflags. The tests might not run; they may encounter compiler failures.

See 00TEST for more information on the UNIX dialects where the test suite has been validated and on the workings of TestDB and its supporting scripts.

When the tests/Makefile "auto" rule is used, the message is more terse and the condition is fatal.

This suite has not been validated on:

<dialect_description>

No opportunity to continue is offered.

The tests/Makefile "silent" rule will skip checking for the validation footprint.

3.43.1.6 Why do the tests complain they can't stat() or open() /dev/mem or /dev/kmem?

When the tests detect that lsof for the dialect reads its information from kernel memory (i.e., the LT_KMEM definition is present in tests/config.cflags), and when the lsof executable path is ../lsof, the tests make sure they can stat() and open() for read access the relevant kernel memory devices, /dev/kmem and possibly /dev/mem.

If those stat() or open() operations fail, the tests issue an error message and quit. The message explains why the system rejected the operation in terms of system "errno" symbols and messages. More often than not the explanation will be that the process lacks permission to access the indicated device node.

One work-around is to give the lsof executable being tested the necessary permission -- e.g., via chgrp, chmod, etc. -- and set its path in the LT_LSOF_PATH environment variable. (See 00TEST.)

Another work-around is to make sure the process that runs the tests has the necessary permissions -- e.g., run it as root, or enable the process login to access the resources. For example, I can run the tests on my personal work-station

because /dev/kmem and /dev/mem are readable by the "kmem" group and my login is in that group.

3.43.2 LTbigf test issues

3.43.2.1 Why does the LTbigf test say that the dialect doesn't support large files?

Large file support is defined dialect by dialect in the lsof source files and Configure script. If large file support isn't defined there, it isn't defined in the LTbigf test.

If you think that's wrong for a particular dialect, contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

3.43.2.2 Why does LTbigf complain about operations on its config.LTbigf* file?

The LTbigf must be able to write a large file test (size > 32 bits) and seek within it and the process file ulimit size must permit the operation. If the default location for the test file, tests/, isn't on a file system enabled for large file operations or if the process ulimit file block size is too small, lsof will get file operation errors, particularly when seeking

There may be a work-around. Specify the path to a file LTbigf can write in a file system enabled for large file operations a the -poption. Make sure that the ulimit file block size permits writing a large file. For example, presuming /scratch23 is large-file-enabled, and presuming you have permission to raise the ulimit file block size, this shell commands will allow the LTbigf test to run on AIX:

```
$ ./LTbigf -p /scratch23/abe/bigfile
```

(Note: syntax for the ulimit command varies by dialect and by shell. Discovering the proper variant is left to the reader.)

More information on this subject can be found in the LTbigf description in the 00TEST file. If course, the LTbigf.c source file in tests/ is the ultimate source of information,

3.43.2.3 Why does LTbigf warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTbigf knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTbigf ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests have
been disabled.
```

LTbigf then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

3.43.3 Why does the LTbasic test complain "ERROR!!! lsof this ..." and "ERROR!!! lsof that ..."?

The LTbasic test program uses lsof to examine a running lsof process. It looks for the lsof current working directory, executable (if possible), and kernel memory file (if applicable).

Failures to find those things result in the LTbasic error messages. More information on how LTbasic produces the error messages may be found in the LTbasic.c source file.

On HP-UX 11.11 and higher, for example, if the test's current working directory is on a loopback (LOFS) file system, LTbasic won't be able to find the current working directory of the lsof process because of a bug in the HP-UX kernel.

The solution for that HP-UX problem is to install an HP-UX patch. See the answer to the "Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?" question for more information on the patch.

3.43.4 NFS test issues

3.43.4.1 Why does the LTnfs test complain "couldn't find NFS file ..."?

The LTnfs test must work with an NFS test file. After it opens the file it asks lsof to find it on an NFS file system. If the file isn't on an NFS file system, lsof won't find it,

and the NFS test script complains and fails.

The work-around is to use -p option to supply a path to a regular NFS file (not a directory) that is on an NFS file system that LTnfs can read. Presuming /share/bin/file is such a file and can be opened for reading by the LTnfs test, this sample shell command could be used to run the LTnfs test successfully:

```
$ ./LTnfs -p /share/bin/file
```

(If the NFS file system is enabled for large files, the NFS test will produce the error message described in the following Q&A.)

3.43.5 LTnlink test issues

3.43.5.1 Why does the LTnlink test complain that its test file is on an NFS file system?

The LTnlink test may complain:

```
LTnlink ... WARNING!!! test file <path> is NFS mounted.
```

and then issue an explanation and a hint about using the -p option.

The LTnlist test does this because of the way NFS file links are managed when an NFS file is unlinked and the unlinking process still has the file open. Unlike with files on a local file system, when an NFS file that is still open is unlinked, its link count is not reduced.

The file name is changed to a name of the form .nfsxxxx and the link count is left unchanged until the process holding the file open closes it. That's done by NFS so it can keep proper track of the file on NFS clients and servers.

Since the link count isn't reduced when the LTnlink test program closes the NFS test file it still has open, lsof won't find it for LTnlink with a link count of zero. Consequently, LTnlink disables that test section and issues its warning.

The warning suggests that the unlink test section can be run by giving LTnlink a path to a test file with the -p option. That path must name a file LTnlink can write and unlink. Presuming /scratch23/abe/nlinkfile is on a local

file system and the LTnlink test can write to it and unlink it, this sample shell command can be used to run the complete LTnlink test successfully:

```
$ LTnlink -p /scratch23/abe/nlinkfile
```

3.43.5.2 Why does LTnlink delay and report "waiting for link count update: ..."?

On some UNIX dialects and file system combinations the updating of link count after a file has been unlinked can be delayed. Consequently, lsof won't be able to report the updated link count to LTnlink for a while.

When lsof doesn't report the proper link count to LTnlink, it sleeps and repeats the lsof call, using the "waiting for link count update: ..." message as a signal that it is waiting for the expected lsof response. The wait cycle duration is limited to approximately one minute.

3.43.5.3 Why does LTnlink fail because of an unlink error?

LTnlink may fail with an error similar to:

```
LTnlink ... ERROR!! unlink(<name>) failed: (Permission denied).
```

That message will be followed by a short explanation.

The error means that the kernel support for the file system on which the file <name> resides does not allow a process to unlink a file while it has the file open. (When LTnlink is run without the "-p path" option, it creates a <name> that begins with "./config.LTnlink" and ends with the LTnlink process ID number.)

An unlink failure of this type runs counter to original UNIX file system behavior, but it has been observed on some file system types, especially on the ZFS file system.

The work-around is to run LTnlink on a file system that allows a process to unlink a file it has open. Usually /tmp has that support. So, try running LTnlink this way:

```
$ ./LTnlink -p /tmp/<name>
```

where <name> is a unique name in /tmp of your choosing. To be safe, create a subdirectory in /tmp, named by your login:

```
$ rm -f /tmp/<login>
$ mkdir /tmp/<login>
$ ./LTnlink -p /tmp/<login>/<name>
```

3.43.6 LTdnlc test issues

3.43.6.1 Why won't the LTdnlc test run?

Lsof is unable to access the DNLC cache on AIX, because the kernel symbols for the DNLC aren't exported. Contact IBM to learn why that decision was made.

The LTdnlc test won't work on Apple Darwin because lsof can't obtain reliable DNLC information.

The LTdnlc test may fail on other dialects. Failure causes include: a busy system with a DNLC that is changing rapidly; path name components too large for the DNLC; a file system -- e.g., NFS, /tmp, loopback -- which doesn't fully participate in the DNLC; or DNLC limitations (Many DNLC implementations will only store path name components if they are 31 characters or less.)

If you suspect the file system doesn't fully participate in kernel DNLC processing, as a work-around rebuild and test lsof on one that does.

3.43.6.2 What does the LTdnlc test mean by "... <path> found: 100.00% "?

Even when it succeeds the LTdnlc test will report:

```
LTdnlc ... /export/home/abe/src/lsof4/tests found: 100.00%
```

This message means that the LTdnlc test asked lsof to find the file at the indicated path five times and lsof found the full path name in the indicated percentage of calls. The LTdnlc test considers it a failure if the percentage falls below 50.0%

3.43.6.3 Why does the DNLC test fail?

The DNLC test may fail when some component of the lsof tests/ sub-directory can't be cached by the kernel DNLC. Some kernels have a limit on the length of individual components (typically) 32.

3.43.7 Why hasn't the test suite been qualified for 64 bit HP-UX

11 when lsof is compiled with gcc?

When I attempted to qualify lsof for HP-UX 11, compiled with gcc 3.0, the LTsock test failed. I traced the failure to a gcc compilation error. Because LTsock is an important test, I didn't feel that the test suite was qualified if it failed.

LTsock compiles and runs correctly on 64 bit HP-UX 11 when compiled with HP's ANSI-C.

3.43.8 LTzoff test issues

3.43.8.1 Why does LTzoff warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTzoff knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTzoff ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests have
been disabled.
```

LTzoff then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

3.43.9 LTlock test issues

3.44 File descriptor list (the ``-d" option) problems

3.44.1 Why does lsof reject a ``-d" FD list?

Lsof rejects ``-d" FD lists that contain both exclusions and inclusions with messages like:

```
lsof: exclude in an include list: ^1
lsof: include in an exclude list: 2
```

That's because ``-d" FD lists are processed as ORed lists, so it makes no sense for them to contain both exclusions and inclusions.

I.e., if a ``-d" FD list were to contain ``^cwd,1", the ``^cwd" member is useless, because the ``1" member

dominates by saying "include only FD 1". That effectively excludes ``cwd" FD.

Note that lists may have multiple members of the same type, exclude or include. They are processed as an ORed set. If an FD isn't excluded by any member of an exclude list, it is selected. If an FD is included by any member of an include list, it is selected.

3.44.2 Why are file descriptors other than those in my FD list reported?

The FD list that follows ``-d" excludes or includes file descriptors, but unless the ``-a" (AND) option is specified, the FD list selections are ORed to the other selections.

For example, the following lsof command will cause all file descriptors to be listed for the lsof command, and all but the cwd descriptor for all other commands, probably not what was intended.

```
$ lsof -clsof -d^cwd
```

Hint: use ``-a" -- e.g.,

```
$ lsof -clsof -a -d^cwd
```

3.45 How can I supply device numbers for inaccessible NFS file systems?

When lsof can't get device numbers for inaccessible NFS file systems via stat(2) or lstat(2), it attempts to get them from the mount table's dev=xxx options. Successes are reported with a warning message that indicates the source of the device number and that output might be incomplete as a consequence of the warnings.

Some system mount tables -- e.g., Linux /proc/mounts -- don't have a dev=xxx option. In that case, and provided lsof for the dialect supports them, you can use the +m option to create a mount table supplement file and the "+m m" option to use it.

First check the lsof -h (help) output to see if the +m and "+m m" options are supported. If they are, use +m to create a mount table supplement file when all mounted file systems are accessible. Use "+m m" later to make the supplement available when some mounted file systems might not be available.

Here's an example that creates a mount supplement file in \$HOME/mnt-sup and later makes it available to lsof.

```
$ rm -f $HOME/mnt-sup
$ lsof +m > $HOME/mnt-sup
...
$ lsof +m $HOME/mnt-sup <other lsof options>
```

If lsof has to get the device number from the supplement, it will issue an informative warning message. The warning can be suppressed with lsof's -w option.

Caution! Since the mount table supplement file is static, it is its supplier's responsibility to update it as file system mounts change.

For more information, consult the lsof man page. The "ALTERNATE DEVICE NUMBERS" section has useful information on how lsof acquires device numbers when stat(2) or lstat(2) fail.

3.46 Why won't lsof find open files on over-mounted file systems?

When a file system, /xyz for example, is mounted on the same mount point as another file system, /abc for example, running lsof with an argument of the path of the first file system's mount point -- the over-mounted one, /abc -- probably will not reveal any files open on /abc.

That's because lsof looks for open files on a file system by looking for files with the file system's device number. The two file systems usually have different device numbers and lsof determines the device number search key from the supplied name of the second file system.

A general work-around exists only for Linux. On that UNIX dialect, when you know the over-mounted file system's mount point path, you can ask lsof to report on all open files and grep that output for the path of the over-mounted file system mount point.

3.47 What can be done when lsof reports no more space?

Many lsof methods cache information in memory, using the dialects malloc() library function. When malloc() can't allocate the requested amount of memory, lsof exits with warning messages similar to this AIX message:

lsof: no more dev-ch space at pid 2257750: 0x82a8e600

Lsof then exits immediately and produces no more output.

A possible work-around is to increase the memory footprint of the shell that runs lsof. That is often done with the `ulimit(1)` shell command.

3.48 What if the lsof build encounters ar and ld problems?

The lsof main and library Makefiles use the library archiver, ar, and the system loader, ld, applications. Improperly located, installed or configured versions of them may cause the lsof build to encounter errors with them.

The application producing the error should identify itself in its error messages.

The first thing to check is the path of the application that is being used. Try `which ar` or `which ld` to see if perhaps the PATH used during the build might be causing the wrong archiver or loader to be used.

If the problem is with the use of the wrong archiver, and it's not possible to correct the PATH to it, try using the `LSOF_AR` environment variable to specify the path to and arguments for the correct archiver. See `OOXCONFIG` for more information and note that `LSOF_AR` must specify the path to the archive application and the arguments for it, less the terminating library and module name arguments.

If the problem is with the loader, there is no lsof work-around. That's because lsof calls the loader via the C compiler, so the problem must be fixed at the compiler (system) level.

4.0 AIX Problems

4.1 What is the Stale Segment ID bug and why is -X needed?

Kevin Ruderman reports that he has been informed by IBM that processes using the AIX 3.2.x, 4.1[.12345], 4.2[.1], and 4.3.x kernel's `readx()` function can cause other AIX processes to hang because of what appears to be file system corruption.

This failure, known as the Stale Segment ID bug, is caused

by an error in the AIX kernel's journaled segment memory handler that causes the kernel's `dir_search()` function erroneously to believe directory entries contain zeroes. The process using the `readx()` call need not be doing anything wrong. Usually the system must be under such heavy load that the segment ID being used in the `readx()` call has been freed and then reallocated to another process since it was obtained from kernel memory.

Lsof uses the `readx()` function to access library entry structures, based on the segment ID it finds in the `proc` structure of a process. Since IBM probably will never fix the kernel bug, I've added an AIX-specific option to lsof that controls its use of the `readx()` function.

By default lsof `readx()` use is disabled; specifying the `--X` option enables `readx()` use.

If you want to change the default `readx()` behavior of AIX lsof, change the `HASXOPT`, `HASXOPT_ROOT`, and `HASXOPT_VALUE` definitions in `dialects/aix/machine.h`. You can also use these definitions to enable or disable `readx()` -- consult the comments in `machine.h`. You may want to disable `readx()` use permanently if you plan to make lsof publicly executable.

When `HASXOPT_ROOT` is defined, lsof will restrict use of the `-X` option to processes whose real UID is root; if `HASXOPT_ROOT` isn't defined, any user may specify the `-X` option. The `Customize` script offers the option to change `HASXOPT_ROOT` when `HASXOPT` is defined and `HASXOPT_ROOT` is named in any dialect's `machine.h` header file.

I have never seen lsof cause a problem with its use of `readx()`, but I believe there is some chance it could, given the right circumstances.

4.1.1 Stale Segment ID APAR

Here are the details of the Stale Segment ID bug and IBM's response, provided by Kevin Ruderman.

AIX V3

APAR=ix49183

user process hangs forever in kernel due to file system corruption

STAT=closed prs TID=tx2527 ISEV=2 SEV=2

(A "closed prs" is one closed with a Permanent Restriction.)

RCOMP=575603001 aix v3 for rs/6 RREL=r320

AIX V4 (internal defect, no apar #)

prefix p
name 175671
abstract KERMP: loop for ever in dir_search()

Problem description:

1. Some user application -- e.g., lsof -- gets the segment ID (SID) for the process private segment of a target process from the process table.
2. The target process exits, deleting the process private segment.
3. The SID is reallocated for use as a persistent segment.
4. The user application runs again and tries to read the user area structure from /dev/mem, using the SID it read from the process table.
5. The loads done by the driver for /dev/mem cause faults in the directory; new blocks are allocated; the size changed; and zero pages created.
6. The next application that looks for a file in the affected directory hangs in the kernel's dir_search() function because of the zero pages. This occurs because the kernel's dir_search() function loops through the variable length entries one at a time, moving from one to the next by adding the length of the current entry to its address to get the address of the next entry. This process should end when the current pointer passes the end of the known directory length.

However, while the directory length has increased, the entry length data has not, so when dir_search() reaches the zero pages, it loops forever, adding a length of zero to the current pointer, never passing the end of the directory length. The application process is hung; it can't be killed or stopped.

IBM closed the problem with a PRS code (Permanent Restriction) under AIX Version 3 and had targeted a fix for AIX 4.2. They have recently (I became aware of it September 10, 1996) cancelled the defect report altogether and have indicated they are not going to fix the defect.

4.2 Gcc Work-around for AIX 4.1x

When gcc is used to compile lsof for AIX 4.1x, it doesn't align one element of the user structure correctly. Xlc sees the U_irss element as a type "long long" and aligns it on an 8 byte boundary. That's because the default mode of xlc is -qlonglong; when -qlonglong is enabled, the _LONG_LONG symbol is also defined.

Gcc sees U_irss as a two element array of type long, because _LONG_LONG isn't defined. Hence gcc aligns the U_irss element array on a 4 byte boundary, rather than an 8 byte one, making the gcc incantation of the user structure 4 bytes shorter than xlc's.

When the length of gcc's user structure is supplied as argument 4 to the undocumented getuser() function of the AIX kernel, getuser() rejects it as an incorrect size and returns EINVAL.

Lsof has a work-around for this problem. It involves a special test in the Configure script when the "aixgcc" Configure abbreviation is used -- e.g.,

```
$ Configure -n aixgcc
```

The test is to compile a small program with gcc and check the alignment of U_irss. If it's not aligned on an 8 byte boundary, the Configure script makes a special copy of <sys/user.h> in ./dialects/aix/aix<AIX_version> whose U_irss will align properly, and generates compile time options to use it.

While I have tested this work-around only with 4.1.4, it should work with earlier versions of AIX 4.1. It does not work for AIX 4.2; a different work-around is employed there. (See the next section.)

If you want to use this technique to compile other AIX 4.1x programs with gcc for using getuser(), check the Configure script.

Stuart D. Gathman identified this gcc AIX alignment problem.

4.3 Gcc and AIX 4.2[.1]

Alignment problems with gcc and AIX 4.2[.1] inside the user

structure are more severe, because there are some new 64 bit types in AIX that gcc doesn't yet (as of 2.7.x) support. The `<sys/user.h>` `U_irss` element problem, discussed in 4.3 above, doesn't exist in 4.2[.1].

The AIX `lsof machine.h` header file has a work-around, provided by Henry Grebler, that bypasses gcc alignment problems. Later versions of gcc (e.g., 2.8.x) will probably bypass the problems as well.

4.4 Why won't `lsof's` `Configure` allow the use of gcc for AIX below 4.1?

Gcc can't reliably be used to compile `lsof` for AIX versions below AIX 4.1 because of possible kernel structure element alignment differences between it and `xlC`.

4.5 What is an AIX SMT file type?

When you run AIX X clients with the `DISPLAY` environment variable set to ```:0.0`" they communicate with the AIX X server via files whose kernel file structure has an undefined type (`f_type == 0xf`) -- at least there's no definition for it in `<sys/file.h>`.

These are Shared Memory Transport (SMT) sockets, an artifact of AIXWindows, designed for more efficient data transfers between the X server and its clients.

Henry Grebler and David J. Wilson alerted me to the existence of these files. Mike Feldman and others helped me identify them as SMT sockets.

The curious reader can find more about SMT sockets in `/usr/lpp/X11/README.SMT`.

4.6 Why does AIX `lsof` start so slowly?

When AIX `lsof` starts it compares the running kernel's identity to the one for which it was built, using `/usr/bin/oslevel`. That comparison can sometimes take a long time to complete, depending on the system's maintenance level and how recently it was examined with `oslevel`.

AIX revisions 4.67 and above for AIX 5 and above don't use `oslevel` to determine the kernel identity. They use `uname(2)` instead, and it is much faster.

You can skip the oslevel test by suppressing warning messages with lsof's -w option. Doing that carries with it the risk of missing other warning messages, however.

You can also disable the kernel identity check by disabling the definition of the HASKERNIDCK symbol by editing AIX machine.h header file or by using the Customize script to disable it.

See the "Why does lsof warn "compiled for x ... y; this is z.?" section for more information.

4.7 Why does exec complain it can't find libc.a[shr.o]?

When you try to execute lsof you may get this complaint:

```
exec(): 0509-036 Cannot load program ./lsof because of
the following errors:
0509-022 Cannot load library libc.a[shr.o].
0509-026 System error: A file or directory in
the path name does not exist.
```

This is probably the result of making lsof when the LIBPATH environment variable contained a directory path that doesn't contain libc.a. You can see what LIBPATH contained when lsof was made by using the dump application on lsof. For example, if LIBPATH contained /foo/bar when lsof was made, you will see this (partial) dump output:

```
$ dump -H lsof
...
***Import File Strings***
INDEX PATH          BASE      ...
0    /foo/bar
```

To correct the problem, revisit the lsof source directory and remake lsof this way:

```
$ unset LIBPATH; make (sh or ksh)
or
% unsetenv LIBPATH; make (csh or tcsh)
```

4.8 What does lsof mean when it says, "no PCB, CANTSENDMORE, CANTRCVMORE" in a socket file's NAME column?

When an AIX application calls shutdown(2) on an open socket file, but hasn't called close(2) on the file, the file will remain visible to lsof as an open socket file without any

extended protocol information.

Lsof reports that state in the NAME column by saying that there is "no PCB" (Protocol Control Block) for the protocol (e.g., TCP in the NODE column). If the open socket file has the state variables SO_CANTSENDMORE and SO_CANTRCVMORE set -- i.e., from the shutdown(2) call -- lsof reports them with the CANTSENDMORE and CANTRCVMORE notes in the NAME column.

4.9 When the -X option is used on AIX 4.3.3, why does lsof disable it, saying "WARNING: user struct mismatch; -X option disabled?"

The -X option causes lsof to read the loader information of the user structure from virtual memory via the readx() system call. It does that with the user structure definition from <sys/user.h> that was compiled into the lsof executable.

On AIX 4.3.3 there are two different user structure definitions in two separate <sys/user.h> header files, distributed at different times by IBM. If lsof was compiled with one and the kernel on which lsof is being run was compiled with the other, lsof normally won't get correct loader information when it calls readx().

In an attempt to compensate for that difference, lsof makes an independent check of the loader information by getting the user structure's open file count via readx() and comparing it to the open file count obtained independently via getprocs(). When the two counts don't match, lsof tries to read the count (and re-read the loader information) with two offsets, based on observed differences between the two user structures.

When one of the three attempts produces a correct open file count, lsof uses its corresponding offset on subsequent readings of the loader information.

When none of the three attempts produces a correct open file count, lsof issues the WARNING message and disables -X processing.

To eliminate this problem, obtain an lsof binary that matches the kernel of the AIX 4.3.3 system where you want to run lsof. Compiling lsof on the target system is the preferred way to get a matching binary.

4.10 Why doesn't the -X option work on my AIX 5L or 5.[123] system?

If your AIX 5L or 5.[123] system uses the ia64 architecture, lsof needs setuid-root permission to be able to do the processing that -X requires.

Check the output of `uname -a` to determine the architecture type.

The work-around is to give lsof setuid-root permission.

4.11 Why doesn't /usr/bin/oslevel report the correct AIX version?

The oslevel man page says, "The oslevel command reports the level of the operating system using a subset of all filesets installed on your system."

You can see which fileset is below the expected level with oslevel's -l option. For example, if you believe your system is at AIX level 4.3.3, but oslevel reports 4.3.2, use this oslevel command to find the filesets below 4.3.3:

```
$ /usr/bin/oslevel -l 4.3.3.0
```

If you don't know what level argument to supply to oslevel's -l option, use oslevel's -q option first.

4.11.1 Why doesn't /usr/bin/oslevel report the correct AIX version on AIX 5.1?

The subset list for oslevel on AIX 5.1 seems to include at least two filesets, xlsmp.msg.en_US.rte and xlsmp.rte, that do not install from AIX 5.1 media with a 5.1.0.0 level. Hence, oslevel reports 5.0.0.0 instead of the expected 5.1.0.0.

If either xlsmp.msg.en_US.rte or xlsmp.rte is installed, lsof's Configure script and run-time tests will identify the AIX version incorrectly. The run-time test will issue a complaint message of this form:

```
lsof: WARNING: compiled for AIX version xxx; this is yyy.
```

You can correct the Configure test by pre-defining the oslevel value, setting the correct value in the LSOF_VSTR environment variable before running the Configure script -- e.g., to pre-define AIX 5.1 when using ksh, do this:

```
$ LSOF_VSTR=5.1.0.0 Configure -n aix
```

You can't affect oslevel output without uninstalling `xlsmp.msg.en_US.rte` and `xlsmp.rte`. If you can't do that, you'll have to put up with the run-time complaint.

4.12 Why does lsof for AIX 5.1 or above Power architecture complain about kernel bit size?

When you run an lsof binary on an AIX 5.1 or above Power system, it might complain:

```
lsof: FATAL: compiled for a 32 bit kernel.  
The bit size of this kernel is 64.
```

or

```
exec: 0509-036 Cannot load program ./lsof because of  
the following errors:  
0509-032 Cannot run a 64-bit program on a 32-bit  
machine.
```

Starting at lsof revision 4.61, lsof binaries for Power architecture systems running AIX 5.1 or above are closely tied to the kernel bit size. lsof must do that so it can read and understand kernel structures.

lsof's Configure script tunes the lsof configuration so that the binary built in the `make(1)` step is adjusted to the kernel bit size.

An lsof binary knows the bit size for which it was constructed, tests the bit size of the kernel under which it is running, and objects if the two sizes don't match. To see the bit size for which lsof was constructed, run it with its `-v` option and look for these lines in the output:

```
configuration info: 32 bit kernel
```

or

```
configuration info: 64 bit kernel
```

(Note: these lines will appear only in `-v` output for AIX 5.1 and above lsof binaries, built for Power architecture.)

You can see the kernel bit size test method in the `aix` stanza of the lsof Configure script and in the `get_kernel_access()` function of the lsof `.../dialects/aix/dproc.c` source file.

There is more information on pre-defining the kernel bit size when building lsof in `Configure`, `00PORTING`, and `00XCONFIG`.

The only work-around is to use an lsof binary built to match the running kernel bit size.

4.13 What can't gcc be used to compile lsof on the ia64 architecture for AIX 5 and above?

Gcc can't be used to compile lsof on the ia64 architecture for AIX 5 and above because I haven't had access to a system that has a working gcc compiler. The gcc compiler on my one and only ia64 AIX 5.1 test system, provided by IBM, didn't work at all.

4.14 Why does lsof get a segmentation fault when compiled with gcc for a 64 bit Power architecture AIX 5.1 kernel?

When lsof is configured with the lsof "aixgcc" Configure abbreviation, the resulting lsof executable may cause a segmentation violation when it is run. I've observed this with gcc version 2.9-aix43-010414-7.

As far as I have been able to tell, the segmentation fault is the result of a gcc compilation, loading, or library error. Watching lsof run with gcc's companion debugger, gdb, shows no error in the lsof source code that might explain the fault.

The only work-around I know is to use the IBM C compiler in place of gcc -- i.e., use the "aix" lsof Configure abbreviation.

4.15 Why does lsof ignore AFS on my AIX system?

The lsof Configure script quits on AIX when AFS is present, the AIX version is greater than 4.3.3.0 or the AFS version is greater than 3.5. That's because I have no test systems available for those AIX and AFS version combinations.

When the lsof Configure script detects an AIX and AFS version combination that is unsupported, it will report:

```
!!!FATAL: Lsof does not support AFS on this combination of
AIX and AFS versions. To disable AFS, set the
value of the AIX_HAS_AFS environment variable to
"no".
```

The only work-around is to set the AIX_HAS_AFS environment variable as explained in the error message:

```
$ AIX_HAS_NSF=no; export AIX_HAS_NFS
$ ./Configure -n aix
```

4.16 Why does lsof report "system paging space is low" and exit?

When AIX paging space runs low, the AIX kernel sends a SIGDANGER signal to processes, warning them that they should reduce their memory usage.

When lsof receives that signal, it issues the following fatal error message and exits:

```
lsof: FATAL: system paging space is low.
```

A possible work-around is to limit the amount of information lsof must cache in its process memory with the "-c", "-g", "-l" and "-p" options.

Also see the answer to the "What can be done when lsof reports no more space?" question.

4.17 Why does lsof have a compilation problem on AIX 5.3 above maintenance level 1?

On some AIX 5.3 systems with maintenance levels 2 and higher installed, lsof 4.77 and below may not compile properly. The compiler complains the snapshotObject structure definition, needed by <j2/j2_inode.h>, is missing.

That problem is fixed in the 4.78 revision.

5.0 Apple Darwin Problems

5.1 What do /dev/kmem-based and libproc-based mean?

Lsof for Apple Darwin currently uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

At an upcoming release lsof will use a library called libproc to obtain information about open files. That version of lsof will be called libproc-based lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/darwin branch of the lsof source

tree. When the supporting version of Apple Darwin is released, the libproc-based lsof sources will be found in `.../dialects/darwin/libproc`.

5.2 /dev/kmem-based Apple Darwin Questions

5.2.1 Why does Configure ask for a path to the Darwin XNU kernel header files?

When lsof was ported to Apple Darwin by Allan Nathanson at revision 4.53, some kernel header files needed by lsof weren't being exported by the developers. (That's still true at lsof revision 4.76.)

At first a shell script that Allan provided would get the missing header files by checking them out from the CVS root. Although the script was updated from time to time, eventually the re-organization of Darwin sources has made it impossible to update the script to do an automatic download of the missing header files.

At lsof revision 4.69 and above it is necessary for the Darwin lsof builder to download the Darwin XNU kernel headers before attempting to build lsof. The download may be done via a web browser, starting at this URL:

```
http://www.opensource.apple.com/darwinsource/index.html
```

Once there, select the link to the Mac OS X version that matches the one on the system where lsof is to be built.

Follow that link's "[Source]" link. Once there, select the tar.gz link of the xnu* entry near the bottom of the page. That entry should have a name that matches the xnu* name shown by ``uname -a`` -- e.g., if `uname` reports:

```
$ uname -a
... root:xnu/xnu-517.7.21 ...
```

Then the appropriate xnu* entry is xnu-517.7.21. Clicking its link should lead to an "Apple Open Source" page requesting an Apple ID and password.

Enter them if they're available. If an Apple ID and password are not available, get them by following the instructions on the page -- i.e., follow the `signin.apple.com` link.

Once a valid Apple ID and its password have been entered,

the download will begin. Select the saving of the downloaded xnu*.tar.gz file in an appropriate place on the Mac OS X system.

Once the download completes, install it. Use gunzip to decompress the download and tar to extract the archive -- e.g.,

```
$ gunzip -c xnu-517.7.21.tar.gz | tar xf -
```

Remember the absolute path to the extracted archive. That is its installed place. E.g., if the xnu-517.7.21.tar archive was extracted to the lsof builder's home directory, its full installation path will be something like:

```
~/xnu-517.7.21
```

Now run the lsof Configure script. When it asks for the path to the installed Darwin XNU kernel header files, supply the path to the gunzip'd and extracted xnu* archive -- e.g., ~/xnu-517.7.21.

The path to the Darwin XNU kernel headers may also be supplied to the Configure script in the DARWIN_XNUDIR environment variable, eliminating the need to enter it interactively -- e.g.,

```
$ DARWIN_XNUDIR=~/xnu-344.49 ./Configure -n darwin
```

5.2.1.1 Why does Configure complain that Darwin XNU kernel header files are missing?

These are some reasons why the lsof Configure script might claim that Darwin XNU header files are missing:

- * The wrong path to them was specified.
- * The files and directories in the path are not readable and searchable -- i.e., check the modes and ownerships.
- * The downloaded archive doesn't match the Mac OS X version of the system.

If in doubt, revisit the Darwin XNU kernel header file download instructions in the answer to the question "Why does Configure ask for a path to the Darwin XNU kernel header files?"

If Configure still can't find Darwin XNU kernel header

files, contact me via e-mail at <abe@purdue.edu> for help.
Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

5.2.2 Why doesn't Apple Darwin lsof report text file information?

At the first port of lsof to Apple Darwin, revision 4.53, insufficient information was available -- logic and header files -- to permit the installation of VM space scanning for text files. As of lsof 4.70 it is still not available.

Text file support will be added to Apple Darwin lsof after the necessary information becomes available.

5.2.3 Why doesn't Apple Darwin lsof support IPv6?

At the first port of lsof to Apple Darwin, revision 4.53, Apple Darwin lacked IPv6 support. IPv6 became available in Apple Darwin version 1.5 and support for it was added to lsof then.

5.2.4 Why does lsof complain about a mismatch between the release for which lsof was compiled and the booted Mac OS X release?

When lsof is started on the "Gold Master" Darwin release (aka Mac OS X), it complains:

```
lsof: compiled for 1.0 release; this is 1.3.2.
```

This happens because the lsof binary released with Mac OS X was built on a system whose release number (1.0) doesn't match that of the released system -- usually 1.3.x. Lsof makes this check because UNIX dialect OS changes are often accompanied by header file changes that affect lsof.

In this specific case, this error can be ignored. If you don't want to do that, get the lsof distribution and build lsof so its built-on and running-on Mac OS X release numbers match.

5.2.5 Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?

Lsof for Apple Darwin 8 may report messages like these in the NAME column:

```
stat(/private/var/run/asl_prune): No such file or directory  
or
```

stat(/private/var/db/netinfo/local.nidb/Config): Permission denied

Those messages indicate that lsof was unable to collect open file information for the paths enclosed in "stat(...)" with the stat(2) function, because the function encountered the reported error.

A work-around for the "Permission denied" error is to run lsof with elevated privileges -- e.g., when logged on as the super user.

If the stat(2) error message is "No such file or directory", the file probably has been unlinked (removed) and there is no lsof work-around.

5.2.6 What are the limitations of Apple Darwin lsof link count reporting?

Lsof for Apple Darwin cannot report link count information reliably.

For Apple Darwin below 8 link count information is not always available in the kernel node structures available to lsof.

When link count information is available, however, it includes link counts of zero. Thus, using lsof's +L1 option may result in the finding of some files whose link counts are zero.

Lsof can report only some link count information for Apple Darwin 8 and above. Link count information is only available for files where lsof can assemble the full file path and has permission to apply stat(2) to it. (See the answer to the "Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?" question for more information on stat(2) failures.)

Apple Darwin 8 and above files that have been unlinked and thus have a link count of zero cannot be found by stat(2) -- i.e., stat(2) returns a "No such file or directory" error. As a result lsof never displays link counts of zero and the use of lsof's +L1 option to find them always fails.

5.3 Libproc-based Apple Darwin Questions

6.0 BSD/OS BSDI Problems

6.0.5 Statement of deprecation

As of lsof revision 4.76 support for BSDI BSD/OS has been dropped. The 4.76 distribution of lsof for BSDI BSD/OS may be found on lsof.itap.purdue.edu in `pub/tools/unix/lsof/OLD/src`.

7.0 DEC OSF/1, Digital UNIX, and Tru64 UNIX Problems

7.1 Why does lsof complain about non-existent /dev/fd entries?

When you run lsof for Digital UNIX 3.2, lsof may complain:

```
lsof: can't lstat /dev/fd/xxx: No such file or directory
lsof: can't lstat /dev/fd/yyy: No such file or directory
```

(Or it may warn about other missing /dev/fd paths.) When you do an `ls /dev/fd` none of the missing paths are listed.

This is caused by a bug in the DEC library function `getdirentries()`. For some reason, when /dev/fd is a file system mount point, `getdirentries()` returns an incorrect size for it to `readdir()`. (Lsof calls `readdir()` in its `ddev.c readdev()` function.) Because of the incorrect size, `readdir()` goes past the end of the /dev/fd directory buffer, encounters random paths and returns them to lsof. Lsof then attempts to `lstat(2)` the random paths, gets error replies from `lstat(2)`, and complains about the paths.

Duncan McEwan discovered this error and has reported it to DEC. Duncan also supplied an alternate `readdir()` function as a work-around. I've incorporated his `readdir()` in `dialects/osf/ddev.c` (as the static `ReadDir()` function) with some slight modifications, and enabled its use when the `USELOCALREADDIR` symbol is defined.

The `Configure` script defines `USELOCALREADDIR` for Digital UNIX version and 3.2. If you don't want to use Duncan's local `readdir()` function, edit the `Makefile` and remove `-DUSELOCALREADDIR` from the `CFGF` string. When DEC releases a corrected `getdirentries()` function, I'll modify the `Configure` script to stop defining `USELOCALREADDIR`.

7.2 Why does the Digital UNIX V3.2 ld complain about Ots* symbols?

When you compile lsof on your Digital UNIX V3.2 system, `ld` may complain:

```
ld:
Unresolved:
```

```
knlist
_OtsRemainder32Unsigned
_OtsDivide64Unsigned
_OtsRemainder64Unsigned
_OtsDivide32Unsigned
_OtsMove
_OtsDivide32
_OtsRemainder32
*** Exit 1
```

Chris Eleveld reports this happens on Digital UNIX V3.2 systems after the Fortran compiler has been installed.

The best work-around seems to be to remove -lml from the CFGL string in the Makefile produced by Configure -- i.e., change:

```
CFGL= -lml
to
CFGL=
```

According to the V3.2 man page for nlist(3), this shouldn't work, but my testing shows that it does. Although I haven't been able to test this second work-around, you might try adding -lots to CFGL, rather than removing -lml -- i.e., change:

```
CFGL= -lml
to
CFGL= -lml -lots
```

WARNING: my testing also shows that the V2.0 nlist(3) man page means what it says when it calls for -lml -- lsof loaded without -lml under V2.0 can't locate the proc (process) table address.

DON'T REMOVE -lml FROM THE DIGITAL UNIX V2.0 MAKEFILE.

If you run into this problem, please let me know what problem you encountered and how you solved it.

7.3 Why can't lsof locate named pipes (FIFOs) under V3.2?

While lsof for V3.2 can report on named pipes (FIFOs), it can't find them by name. That appears to happen because of the way the V3.2 kernel lstat(2) function reports named pipe device numbers.

The V3.2 kernel reports the device number as 0xffffffff, while the kernel structures for named pipes that lsof examines contain the device number of the file system on which the named pipe resides.

Consequently, lsof can't match the device and inode number pair it receives from applying lstat(2) to the named pipe with any device and inode number pair it finds when scanning kernel structures.

I don't have a work-around. You can, of course, ask for full lsof output and use a post-processing filter (e.g., grep) to locate the named pipe of interest.

This problem doesn't exist under V2.0.

7.4 Why does lsof use the wrong configuration header files? For example, why can't the lsof compilation find cpus.h?

DEC OSF/1, Digital UNIX, and Tru64 UNIX configuration header files describe the hardware and software environment for which your kernel boot file was constructed. For example, /sys/<name>/cpus.h defines the number of CPUs in its NCPUS #define.

Lsof searches for the configuration header file subdirectory in /sys (/usr/sys for Digital UNIX version 4.0 and Tru64 UNIX) by converting the first host name component to capital letters -- e.g., TOMIS is derived from tomis.bio.purdue.edu. If that subdirectory exists, lsof uses header files from it. (Configure reports what subdirectory is being used.)

If Configure doesn't find a host-name derived subdirectory, it prompts you for the entry of a subdirectory name. If you can't find one, quit Configure and run the kernel generation process to create a proper configuration subdirectory. If you don't identify a proper configuration subdirectory and you try to compile lsof, the compiler will complain about missing header files -- e.g., a missing cpus.h.

Once you have located or generated a proper configuration subdirectory, rerun Configure. If you have generated a configuration subdirectory whose name is derived from the host name, Configure will find and use it. If not, you will have to specify its name to Configure.

7.5 Why does lsof indicate incomplete paths with " -- " for Tru64

UNIX 5.1 files?

When lsof can't find a component of a path in the kernel's name cache (aka DNLC), or can't determine that the left-most component has as its parent the file system root, it uses an "incomplete path" notation. That notation begins with the file system root name, followed by "--", followed by the consecutive path name components lsof was able to find in the DNLC -- e.g., "/ -- init".

Because the DNLC was significantly redesigned in Tru64 UNIX 5.1, lsof's handling of the cache had to be completely redone. As part of the DNLC redesign a name cache entry parameter lsof formerly used to locate the file system root of a path was removed. With help from Chang Song I've been able to implement an alternate method for detecting the root of these file system types: AdvFS (MSFS), CDFS, DVDFS, FDFS, NFS, NFS3, and UFS.

When lsof doesn't know how to identify the root for a file system type, it will resort to the "--" incomplete path notation.

7.6 Why doesn't lsof report link count, node number, and size for some Tru64 5.x CFS files?

lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the system where lsof runs, so lsof cannot report them.

7.7 Why does lsof say it can't read the kernel name list or proc table on Digital UNIX 4.x or Tru64 UNIX?

By default on Digital UNIX 4 and Tru64 UNIX lsof reads the addresses for kernel symbols with the knlist(3) function. That function can fail, for example, when the kloadsrv daemon isn't running or is malfunctioning. When that happens, lsof may abort with one of these error messages:

lsof: can't read kernel name list from knlist(3): ...

or

lsof: can't read proc table info

The first message suggests a complete knlist(3) or kloadsrv failure; the second, a partial one.

If you know the name of the file from which the running

system was booted, e.g., /vmunix, you can use lsof's -k option to direct it to read kernel symbol addresses from the name list of that file --

```
$ lsof -k /vmunix ...
```

If that works, then knlist(3) is malfunctioning and you need to fix it.

8.0 FreeBSD Problems

8.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open FreeBSD kernfs files because the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

8.2 Why doesn't lsof work on my FreeBSD system?

If lsof doesn't work on your FreeBSD system, first make sure you have the latest lsof revision. See the answer to the "Where do I get lsof?" question for information on how to get the latest lsof revision.

Once you have gotten the latest lsof revision, Configure and make it. If Configure fails -- e.g., it complains about an unknown FreeBSD version -- then lsof probably hasn't been ported to your FreeBSD version yet, and there's no need to go any further. Follow the answer to the "How do I report an lsof bug" to report the Configure complaint to me.

If you are able to Configure and make lsof, run its test suite. (See the answer to the "Is there a test suite?" question for more information on how to use lsof's test suite.)

If lsof still fails, make sure your kernel sources, kernel header files, kernel boot file, standard header files and libraries are synchronized. They should all be built from the same CVS refresh. (Don't forget to do a "make buildworld" followed by a "make installworld".) If they aren't, then the KVM library or lsof may be using kernel structure definitions that don't match the booted kernel; or lsof may fail to compile properly because of header files in /usr/src/sys/sys and /usr/include/sys that don't match.

If you have synchronized your kernel, header files and libraries, and still can't get lsof to work, follow the steps in the answer to the "How do I report an lsof bug" question to report the problem to me.

8.3 Why doesn't lsof work on the RELEASE version of CURRENT?

Lsof tracks the CURRENT release of the current leading edge FreeBSD version, because my access to leading edge FreeBSD is limited to FreeBSD.org reference systems, all running the CURRENT release.

Sometimes that tracking leads to changes in lsof that won't work on an earlier RELEASE version of the current leading edge version.

When that happens, please send e-mail to me <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

8.4 Why does kvm_open() complain it can't find some file?

If lsof issues this complaint:

```
lsof: kvm_open(execfile=/boot/kernel/kernel,  
corefile=/dev/mem: No such file or directory
```

Your FreeBSD system might not have a /dev/mem device. If not, create one -- e.g., as root do:

```
# mknod /dev/mem c <major> 0  
# chmod 440 /dev/mem  
# chgrp kmem /dev/mem
```

For <major> use /dev/kmem's major device number.

You may have to run kldload, too -- again as root do:

```
# kldload mem
```

8.5 FreeBSD ZFS Problems

8.5.1 Why does FreeBSD lsof report "WARNING: no ZFS support has been defined."?

Lsof issues that message when it detects a file on a ZFS file system, but has not been built with support for ZFS. Lsof's Configure script detects support can be added for ZFS when it

finds this file:

```
/usr/src/sys/contrib/opensolaris/uts/common/fs/zfs/sys/zfs_znode.h
```

That header file and others in the OpenSolaris files in
/usr/src enable lsof to extract information about ZFS files
from the kernel structures associated with them.

8.6 Why can't Configure create lsof_owner.h for FreeBSD 6 and above?

Lsof may report:

```
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c  
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c  
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
```

or

```
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c  
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
```

Those messages mean that lsof's Configure script failed to
create a local header file, ./lockf_owner.h, needed to use the
new kernel file locking code of some versions of FreeBSD 6 and
above.

The changes that implement that new locking code alter the
lockf structure in <sys/lockf.h> and introduce a new structure,
lockf_entry, to that header file. When Configure detects the
presence of the lockf_entry definition in <sys/lockf.h>, it
tries to construct the local header file, ./lockf_owner.h.

Configure has to do that because an unfortunate side effect of
the new kernel file locking code is that <sys/lockf.h> doesn't
contain the lockf_owner structure definition referenced in its
own lockf structure. Lsof needs to access elements of that
lockf_owner structure to determine if a lock belongs to the
process that has a file open.

The missing lockf_owner structure definition is in the kernel
source file, typically /usr/src/sys/kern/kern_lockf.c.
Configure tries to extract the lockf_owner structure definition
from kern_lockf.c into lsof's local header file, ./lockf_owner.h.
If Configure can't do that, it reports:

```
FATAL ERROR: ./lockf_owner.h creation failed
```

If Configure can't even read kern_lockf.c, it first reports:

```
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
```

The work-around for this problem is to update the FreeBSD kernel /usr/src tree (e.g., do a CVSup or csup) on the system where lsof is to be built and then do a "make buildworld" followed by a "make installworld".

8.6.1 Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?

If, when compiling lsof, the compiler complains with error messages like:

```
dnode.c: In function 'get_lock_state':
dnode.c:113: error: 'struct lockf' has no member named 'lf_flags'
dnode.c:115: error: 'struct lockf' has no member named 'lf_id'
...
```

Then lsof is being built on a system that has new kernel file locking code and lsof's Configure script failed to build a local lockf_owner.h header file with a structure definition lsof needs.

See the "Why can't Configure create lsof_owner.h for FreeBSD 6 and above?" section for more information and a work-around.

8.6.2 Why don't /usr/src/sys/sys/lockf.h and /usr/include/sys/lockf.h match?

This mismatch can cause the errors explained in the answer to the "Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?" question.

If /usr/src/sys/sys/lockf.h has been updated with a CVSup or csup, the new lockf.h won't be propagated to /usr/include/sys until the "make buildworld" and "make installworld" steps have been completed.

9.0 HP-UX Problems

9.1 What do /dev/kmem-based and PSTAT-based mean?

Lsof for HP-UX 11.0 and below uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

Starting with HP-UX 10.10, finding definitions for the

necessary kernel structures became more difficult as HP no longer distributed header files in /usr/include that defined all kernel structures. So I started "inventing" structure definitions by using Q4 to display them.

By HP-UX 11, the process of invention became extremely intensive to support. Following a patch to the ipc_s structure in early 1999, my invented definition of that structure became incorrect. Although I was able to devise a work-around test for the patch with Q4, it was clear that my inventions were bound to cause more problems.

Discussion with HP about the patch led to my proposing that an lsof API in the HP-UX kernel was the proper solution. Much to my surprise, HP agreed. I believe Carl Davidson was the prime mover behind that decision, but I know others participated, among them Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. I am indebted to these folks and HP for their willingness to do this work.

The API was added to the PSTAT interface in a project named PEGLE, Pstat Enhancements for Glance and Lsof. Louis and Sailu did the bulk of the design and implementation work and testing began in March, 2000

HP-UX 11.11 is the first version that provides PSTAT support for lsof. HP-UX versions in between 11.0 and 11.11 -- all Beta versions as far as I can determine -- have no lsof support.

See the "PSTAT-based HP-UX lsof Questions" section for questions and answers specific to PSTAT-based HP-UX lsof. The next section, "Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?" covers /dev/kmem-based HP-UX lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/hpux branch of the lsof source tree. The PSTAT-based lsof sources may be found in .../dialects/hpux/pstat.

9.2 /dev/kmem-based HP-UX lsof Questions

The sources for /dev/kmem-based lsof for HP-UX may be found in lsof_<revision>/dialects/hpux/kmem.

Lsof's Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory doesn't exist.

Lsof can be forced to use the /dev/kmem sources by setting "/dev/kmem" in the HPUX_BASE environment variable. Consult the Configure shell script and 00XPORTING for more information.

9.2.1 Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?

If you only have the standard (bundled) HP-UX C compiler and haven't purchased and installed the optional one, then you can't use cc's -O option. The HP-UX cc(1) man page says this:

"Options

Note that in the following list, the cc and c89 options -A , -G , -g , -O , -p , -v , -y , +z , and +Z are not supported by the C compiler provided as part of the standard HP-UX operating system. They are supported by the C compiler sold as an optional separate product."

Lsof's Configure script tries to detect what C compiler product you have installed by examining your compiler. If that examination reveals a standard (bundled) compiler, lsof avoids using -O.

If the Configure compiler test fails, the C compiler will complain that it doesn't support -O. You can suppress that complaint with this make invocation:

```
$ make DEBUG=""
```

9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

Pasi Kaara, who originally provided the HP-UX CCITT support, reports that it no longer works under HP-UX 10.x. Consequently, at lsof revision 4.02 it has been disabled.

9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

Some HP-UX 10.x header files, needed by lsof, can't be compiled properly in ANSI_C mode; structure element definition and alignment problems result. The f_offset member of the file structure, for example, is incorrect.

This ANSI-C obstacle extends to using the -Aa option of the HP C compiler and the -ansi option of gcc.

9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

Lsof's Configure script looks in /bin and /usr/ccs/bin for an HP C compiler, because it needs to know if the compiler is the standard (bundled) one or the optional separate product. If it finds no compiler in either place, Configure quits after complaining:

```
No executable cc in /bin or /usr/ccs/bin
```

If you don't have a C compiler in either of these standard places, you should consider installing it. If you have gcc installed, you can use it by declaring the ``hpuxgcc'' abbreviation to Lsof's Configure script.

If you have a C compiler in a non-standard location, you can use the HPUX_CCDIR[12] environment variables to name the path to it. Consult the 00XCONFIG file of the Lsof distribution for more information.

9.2.5 Why does Configure complain about q4 for /dev/kmem-based Lsof for HP-UX 11?

When you run Configure on an HP-UX 11 system, it may complain:

```
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!  
Configure can't use /usr/contrib/bin/q4 to examine the ipis_s  
structure. You must do that yourself, report the result in  
the HPUX_IPC_S_PATCH environment variable, then repeat the  
Configure step. Consult the Configure script's use of  
/usr/contrib/bin/q4 and the 00XCONFIG file for information  
on ipis_s testing and the setting of HPUX_IPC_S_PATCH.  
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!
```

This message states that Configure cannot use q4 from /usr/contrib/bin to examine the kernel's boot image for the ipis_s structure. Maybe q4 hasn't been installed, or perhaps Configure can't execute it.

Lsof needs to gather information about ipis_s to determine if the ipis_s structure is defined in the kernel boot image, if the ipis_s structure of the kernel boot image has an ipis_msgsqueued member, and if the ipc_s structure of the kernel boot image uses has an ipc_ipis member.

The ipis_s structure isn't described in any header file HP-UX releases with HP-UX 11. It appears in the private Lsof header file ../dialects/hpux/kmem/hpux11/ipc_s.h. Lsof gets local and remote connection addresses (IP and

port numbers) from `ipc_s`, so an incorrect `ipc_s` definition may cause incorrect reporting of TCP/IP connection addresses. It definitely will cause incorrect reporting on 32 bit kernels. In any case `lsof` should be compiled with a correct `ipc_s` definition no matter the kernel bit size, so the `Configure` script always tests for it when the HP-UX version is 11.

For `lsof`'s `Configure` script to gather the necessary `ipis_s` information `q4` needs to be installed in `/usr/contrib/bin` and the kernel boot image, `/stand/vmunix`, needs to have been processed with `pxdb`. If either is untrue, `lsof` issues the above error message, perhaps preceded by `q4` messages. (Note: `lsof`'s use of `q4` may also fail if `q4` can't execute `nm --` e.g., it can't find `/usr/bin/nm`, or there is a conflicting, private version of `nm` earlier in the path.)

If `/stand/vmunix` hasn't been processed by `pxdb`, the `q4` messages will include:

```
q4: (error) vmunix not pxdb'd
or
q4: (warning) /stand/vmunix has not been processed by pxdb.
```

It's possible to make a suitable private copy of `/stand/vmunix` for configuring `lsof`. That requires `/opt/langtools/bin/pxdb` or the `q4` version of `pxdb` from `/usr/contrib/bin/q4pxdb`. The path to the result is supplied to the `lsof` `Configure` script in the `HPUX_BOOTFILE` environment variable. `Configure` still requires `/usr/contrib/bin/q4`.

The following sample Bourne shell commands make a private copy of `/stand/vmunix` in `/tmp`, process it with `pxdb` or `q4pxdb`, and supply its path to `lsof`'s `Configure` script in `HPUX_BOOTFILE`.

```
$ cp /stand/vmunix /tmp/vmunix.lsof

$ /opt/langtools/bin/pxdb /tmp/vmunix.lsof
or
$ /usr/contrib/bin/q4pxdb /tmp/vmunix.lsof

... pxdb messages ...
$ HPUX_BOOTFILE=/tmp/vmunix.lsof Configure -n hpux
```

It may also be necessary to use `q4` outside the `lsof` `Configure` script. In that case `q4` can be to determine the state of `ipis_s` and `ipc_s` with these `q4` commands:


```
$ /usr/contrib/bin/q4 /stand/vmunix
```

```
...
```

```
q4> fields -c struct ipc_s
```

```
...
```

```
q4> fields -c struct ipis_s
```

Look in the q4 output for the ipc_ipis member of the ipc_s structure, and look in the q4 output for the ipis_s structure for the ipis_msgsqueued member. If ipc_s has ipc_ipis but ipis_s lacks ipis_msgsqueued, set HPUX_IPC_S_PATCH environment variable to "1". If ipc_s has ipc_ipis and ipis_s has ipis_msgsqueued, set HPUX_IPC_S_PATCH to "2" -- e.g.,

```
$ HPUX_IPC_S_PATCH=1 Configure -n hpux
```

```
or
```

```
$ HPUX_IPC_S_PATCH=2 Configure -n hpux
```

If ipc_s has no ipc_ipis member, set HPUX_IPC_S_PATCH to "N" -- e.g., use this Configure step:

```
$ HPUX_IPC_S_PATCH=N Configure -n hpux
```

9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?

When the lsof Makefile asks the HP-UX unbundled compiler to load lsof, it may complain:

```
/bin/cc -o lsof -DHPUXV=1100 -DHASVXFS -DHPUXKERNBITS=64 \  
-I/home/abe/src/lsof4/dialects/hpux/kmem/hpux11 +DD64 \  
-DHAS_IPC_S_PATCH=2 -I/home/abe/src/lsof4/dialects/hpux/kmem \  
-DLSOF_VSTR="B.11.00" -g dfile.o dmnt.o dnode.o dnode1.o \  
dnode2.o dproc.o dsock.o dstore.o arg.o main.o misc.o \  
node.o print.o proc.o store.o usage.o -L./lib -llsof -lelf \  
-lnsl  
aCC runtime: ERROR: Unexpected use of shared libraries  
aCC runtime: ERROR: Read aCC manpage, +A option  
/usr/lib/nls/loc/locales.1//is_IS.iso88591
```

This is a bug in the HP-UX national language support. (Notice the last message with "locales" in it?) Complain to HP -- then use this work-around before executing make:

```
$ unset LANG
```

```
$ make
```

9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file

link counts, node numbers, and sizes correctly?

This is usually the result of running an lsof binary whose revision number is less than 4.57 on a system that has OnlineJFS support installed. It can also happen with lsof 4.57 binaries when the OnlineJFS support with which they were built doesn't match the OnlineJFS status of the system on which they are run.

The OnlineJFS status of lsof 4.57 and higher binaries can be determined by running:

```
$ lsof -v 2>&1 | grep HASONLINEJFS
```

If that shell pipe produces output, lsof was compiled with OnlineJFS support enabled; no output, disabled.

If OnlineJFS is installed on an HP-UX 11 system the /sbin/fs/vxfs/subtype executable exists and outputs "vxfs3.3" when run.

The problem occurs because the optional OnlineJFS support installation doesn't update <sys/fs/vx_inode.h>. Consequently lsof can be compiled with an incorrect definition of the vx_inode structure and look for link counts, node numbers, and sizes in the wrong places in the structure.

The current response I have gotten from HP is that no <sys/fs/vx_inode.h> update will be provided for OnlineJFS.

I've addressed this problem temporarily with a work-around (hack) in lsof revision 4.57.

9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit HP-UX 11?

When Configure is given the "hpuxgcc" abbreviation, the HP-UX version is 11, and the kernel bit size is 64, the lsof Configure script may abort with the messages:

```
!!!!!!!!!!!!!!!!!!!! FATAL ERROR !!!!!!!!!!!!!!!!!!!!!
```

```
APPARENTLY GCC CANNOT BUILD 64 BIT EXECUTABLES.  
A COMPILER MUST BE USED THAT CAN. SEE 00FAQ  
FOR MORE INFORMATION.
```

(This is the "more information" in 00FAQ.)

This means the Configure script compiled a test program with gcc the result wasn't an ELF-64 binary. Lsof tries two gcc modes, one with no options and another with the -mlp64 option, before it concludes gcc can't be used.

See the "How can I acquire a gcc for building lsof for 64 bit HP-UX 11?" answer for information on where you might be able to get a gcc for HP-UX 11 that can produce ELF-64 executables.

9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?

Check this HP URL:

http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,547,00.html

(That's one very long link; be careful you cut 'n paste it all.)

In November 2001 that URL led to a web page whose title was "gcc for hp-ux 11." The page offered a link for downloading a 64 bit gcc 3.0 compiler for HP-UX 11.0 and 11i. Rich Rauenzahn of HP installed that compiler on an HP test system he allows me to use and I successfully built a 64 bit lsof with it.

The HP package may install the 64 bit capable gcc in /usr/local/pa20_64/bin/gcc, so you may have to adjust your path or set the LSOF_CC environment variable to compensate.

9.2.9 Why does /dev/kmem-based lsof for HP-UX 11 report "unknown file system type" for some open files?

The lsof binary being used probably doesn't have support for the VxFS file system.

To confirm that, check `lsof -v` output for "-DHASVXFS". If it's not present, lsof doesn't have VxFS support.

You also need to establish that lsof really is complaining about VxFS files by checking the kernel boot file for the symbol associated with the hexadecimal address reported in the "unknown file system type" message -- e.g., "v_op: 0x8711c8." Use nm(1) to do that:

```
$ nm -x /stand/vmunix | grep 8711c8
```

If nm reports the symbol associated with the address is

vx_vnodeops, then lsof is complaining about an open VxFS file.

The solution in that case is to build lsof yourself (The bundled C compiler will do it.), making sure that lsof's Configure script detects the presence of VxFS. Configure does that by finding these two header files:

```
/usr/include/sys/fs/vx_hpux.h
/usr/include/sys/fs/vx_inode.h
```

If the system where you are building lsof doesn't have those header files, but does have VxFS, you might be able to install the header files by installing the HP JournalFS package from the CoreOS CD -- in particular the file set JournalFS.VXFS-PRG and its associated patch, PHKL_18543. (My thanks to Steve Bonds for that information.)

Finally, if you find that lsof isn't complaining about VxFS when it complains about an unknown file system type, send e-mail to me <abe@purdue.edu> for further assistance. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?

When compiling lsof on HP-UX 11, the HP ANSI-C compiler's pre-processor, cpp, may complain about comments in HP-UX header files -- e.g.,

```
cpp: "/usr/include/sys/cdfs.h", line 232: warning 2028:
Found comment inside comment started on line 232.
cpp: "/usr/include/sys/cdnode.h", line 196: warning 2028:
Found comment inside comment started on line 196.
cpp: "/usr/include/nfs/snnode.h", line 30: warning 2028:
Found comment inside comment started on line 30
```

This is not a problem with lsof. It is a problem with the HP-UX header files; they have non-compliant ANSI-C comment sequences in them -- e.g.,

```
<sys/cdfs.h>: 232
/* struct cdfs *cdfs_link; /* linked list of file systems */
```

The initial "/*" is not terminated by an ending "*/" before the appearance of a second "/*".

9.2.11 Why does dnodel.c cause the HP-UX 11 compiler to complain that

<sys/fs/vx_inode.h> is missing or incorrect?

If CFLAGS in the lsof Makefile for an HP-UX 11 compilation includes HASONLINEJFS, indicating the system has OnlineJFS support, lsof needs the <sys/fs/vx_inode.h> header file. Sometimes it is missing from /usr/include/sys/fs.

<sys/fs/vx_inode.h> is a header file that must be obtained from Veritas. If that proves impossible, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

9.3 PSTAT-based HP-UX lsof Questions

The sources for PSTAT-based lsof for HP-UX may be found in lsof_<revision>/dialects/hpux/pstat.

lsof's Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory exists.

lsof can be forced to use the PSTAT-based sources by setting "pstat" in the HPUX_BASE environment variable. Consult the Configure shell script and 00XPORTING for more information.

9.3.1 Why does PSTAT-based lsof complain about pst_static and other PSTAT structures?

When lsof starts it may issue one of these fatal error messages:

```
lsof: FATAL: can't determine PSTAT static size
lsof: FATAL: can't read <n> bytes of pst_static
lsof: FATAL: pst_static doesn't contain <name>_size
lsof: FATAL: <name>_size should be <n>
```

These messages indicate that lsof's tests for the proper level of PSTAT support have failed. The structure names, given in <name>, and sizes, given in <n>, identify the support deficiency more precisely.

You may need to upgrade the PSTAT support in your kernel to be able to use PSTAT-based lsof.

9.3.2 Why does PSTAT-based lsof complain it can't read pst_* structures?

Lsof may put messages like the following in the NAME column of its output.

```
can't read cwd pst_filedetails: Permission denied
can't read mem pst_filedetails: Permission denied
can't read rtd pst_filedetails: Permission denied
can't read txt pst_filedetails: Permission denied
can't read pst_filedetails: Permission denied
can't read 3 stream structures: Permission denied
can't read pst_socket: Permission denied
```

These messages indicate that the lsof binary lacks the authority to read the name structures for processes other than ones belonging to the UID under which lsof is running. Authority to read the structures of other processes is limited to root processes -- i.e., lsof must have setuid-root permission if it is to list open files for arbitrary processes.

If you want to eliminate these errors, you must run lsof as root or install it with setuid-root permission.

9.3.3 Why does PSTAT-based lsof rebuild the device cache file after each reboot?

After each HP-UX rebuild, the first time a user runs lsof it will report:

```
lsof: WARNING: device cache mismatch: /dev/tun...
lsof: WARNING: created device cache file: /<user_path>
```

This happens because the device numbers on /dev/tun* device nodes are recalculated at each reboot. When lsof detects a change in the device number of a /dev/tun* file, it rebuilds its local device cache file.

9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?

When lsof can't report TCP addresses for telnetd's open socket files it is because an unpatched PSTAT kernel interface doesn't report the addresses to lsof.

This has been addressed in PSTAT kernel patch PHKL_24047. It is available from the HP IT Resource Center at:

<http://itrc.hp.com>

In the page's "maintenance / support" box select the "individual patches" link. Once at its page, select the "hp-ux" link. On that page select the "Series 800" or "Series 700" radio button and select "11.11" from the pull-down list to the right of the button. Under "search or browse the path list" select "Search by Patch IDs" from the pull down list, enter PHKL_24047 in the following text box, and select search. That should lead to information about PHKL_24047 and a link for downloading it. (You may have to log in first and you may have to create a login identity by registering before you can log in.)

Some time in March 2006 the PHKL_24047 patch was "lost" by the HP-UX networking lab. It has been "found" again in August 2006 and will be re-released as a GRO patch "some time." I don't yet know when that will be. You must contact HP to learn about the availability of the GRO patch.

9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?

When PSTAT-based lsof runs on some HP-UX 11.11 kernels, the kernel may panic. Symptoms include:

Console message:

```
0xFBE000301100EF00 00000000 0000EF00 -  
type 31 = legacy PA HEX chassis-code
```

/var/adm/syslog:

```
... vmunix: Trap Type 15 (Data page fault)  
... vmunix: Instruction Address (pcsq.pcoq) = 0x...
```

The panic is caused by a bug in the way PSTAT's pstat_getstream() function obtains module names from streams managed by the otsam stream driver (part of OSI Transport Services). lsof calls pstat_getstream() when it encounters an open otsam stream file. An HP-UX 11.11 system uses otsam if otsam appears in /stand/system.

HP-UX 11.11 patch PHKL_24507 (available some time after July 15, 2001) fixes the pstat_getstream() bug. See the information in the answer to the "Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?" question for information on how to obtain the patch.

9.3.6 Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?

When PSTAT-based lsof reports on processes whose current working directory (CWD) is on a loopback file system, lsof can't report the open CWD file. The reason is that the HP-UX 11.11 and above kernel's loopback file system code is not passing the CWD file ID to the kernel's pstat(2) code. Hence lsof is given no information on the lsof's CWD.

The problem was first reported to me by Ermin Borovac and an internal bug report was filed with the HP-UX file system group on October 26, 2004. That report has now been answered by the patch PHKL_33200 -- s700_800 11.11 lsof's cumulative patch. The HP IT Resource Center (<http://itrc.hp.com>) is a source for the patch.

9.3.7 Why do some swinstall packages for PSTAT-based HP-UX 11.11 packages complain about setgid and setuid bits?

First, let me explain that I do not provide lsof swinstall packages for lsof. Others provide them and they should be contacted about problems with their packages.

However, I have become aware of a problem with one package about which I have some information I can share. The problem shows up in these swinstall messages:

```
ERROR: Unknown owner and/or group for file
"/usr/local/bin/lsof". SUID and/or SGID bit was
not set.
ERROR: Failed installing fileset "lsof.lsof-RUN,r=4.73".
Check the above output for details.
```

The swpackage SUID/SGID functionality was restricted by changes for POSIX compliance, breaking backward compatibility. The patch PHCO_27671 allows SUID/SGID for uid/gid of 0 only, as a compromise between backward compatibility and POSIX conformance.

If the setuid bit is to be set on the executable, the UID and GID of the executable must be 0 (zero).

9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?

A PA-RISC HP-UX 11.23 bundled C compiler dated May 2005 or later will not build PSTAT-based lsof. It will deliver error messages related to the system's <gssapi/gssapi.h> header file.

There is nothing wrong with that header file or lsof. The problem is that the bundled C compiler can't cope with the gssapi.h header file.

The work-around is to use the HP ANSI C compiler. Using gcc is not a satisfactory work-around. See the answer to the "Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?" question for more information.

9.3.9 Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?

Gcc will not even compile PSTAT-based lsof revisions below 4.77 for PA-RISC HP-UX 11.23 dated May 2005 or later. It reports errors in lsof's print.c fill_portmap() function about missing members of the rpercent structure. That happens because gcc defines _XOPEN_SOURCE_EXTENDED which disables the definition of the rpercent structure in <netdb.h>.

Using the HP bundled C compiler is not a viable work-around. That is explained in the answer to the "Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?"

While an lsof revision 4.77 or higher can be compiled with gcc, the results are unreliable. Lsof will compile, but it occasionally produces segment faults when it runs. I have not been able to reproduce the failure reliably or locate a debugger that will work with the gcc-compiled lsof.

The only reliable work-around is to use the HP ANSI C compiler.

9.3.10 Why does PSTAT-based lsof complain, "FATAL: pst_stream_size should be: 672; is 72" on HP-UX 11.11 and above?

This message indicates a mismatch between the PSTAT header files used to build lsof (<sys/pstat.h> and those in the /usr/include/sys/pstat subdirectory), and those that built the running kernel.

Unfortunately the June 2008 patch set for HP-UX 11.23 creates this inconsistency, because it does not contain all the patches needed to match the kernel with the PSTAT header files. Even more serious is that the missing patches update the kernel's PSTAT support to provide TCP/UDP endpoint information to lsof from TCP/TLI streams.

The patch inconsistency comes about because, while the following patch is installed,

PHKL_36577 1.0 PM-PSTAT section 2 manpage changes

other kernel patches are not.

The PHKL_36577 patch updates the PSTAT header files and manual pages to match kernel changes that other patches with the following numbers (or patches that contain or supersede them) contain:

PHNE_36575 1.0 Cumulative STREAMS Patch
PHNE_37670 1.0 cumulative ARPA Transport patch
PHNE_37851 1.0 NFS cumulative patch

Those patches implement the kernel changes that support the delivery of information promised in patch PHKL_36577.

The work-around is to install the missing patches.

9.4 Why won't the HP-UX depot install?

I don't distribute lsof depots, so I can't support them.

From time to time depots prepared by various sites -- e.g., usually HP-UX software collection sites -- will contain errors that cause installation of the depot to fail.

Do not contact me when this happens. Instead, contact the administrator of the site that prepared the depot.

As should be clear from the bulk of the lsof documentation, I do not recommend you use pre-built lsof binaries in any form. Instead, I recommend you obtain the lsof source distribution and build lsof yourself.

10.0 Linux

10.1 What do /dev/kmem-based and /proc-based lsof mean?

At approximately Linux 2.1.72 and exactly at lsof revision 4.23 support for Linux forks. The first fork, containing the oldest lsof form is based on access to kernel memory structures, and is called /dev/kmem-based lsof. A /dev/kmem-based lsof is heavily intertwined with the Linux kernel version, its header files, and its system map file. Typically a /dev/kmem-based lsof needs only setgid permission to local all open file information.

After approximately Linux 2.1.72 and at revision 4.23 lsof obtains all its information from the /proc file system. That lsof is called the /proc-based lsof. A /proc-based lsof does not read kernel memory, needs neither kernel header files nor the system map file, and is less likely to be affected by Linux kernel changes. However, it does require setuid-root permission to list all open files, and it can't report file offsets (positions).

After revision 4.52 the /dev/kmem-based Linux sources for lsof are no longer distributed. Information about them may be found in the 00INDEX and README files at:

`ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/src`

10.2 /proc-based Linux lsof Questions

10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?

/proc-based lsof revisions 4.79 and above can only report file offsets (positions) for the files of Linux kernels 2.6.22 and above.

During its initialization /proc-based lsof tests to see if offset information can be obtained. If it cannot, lsof disables offset reporting. If the -o option was selected, lsof also issues this warning:

```
lsof: WARNING: can't report offset; disregarding -o.
```

10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?

/proc-based lsof may report:

```
COMMAND PID ... TYPE ... NODE NAME
pump 226 ... sock ... 309 can't identify protocol
```

This means that it can't identify the protocol (i.e., the AF_* designation) being used by the open socket file. Lsof identifies protocols by matching the node number associated with the /proc/<PID>/fd entry to the node numbers found in selected files of the /proc/net sub-directory. Currently /proc-based lsof examines these protocol files:

```
/proc/net/ax25 (untested)
```

```
/proc/net/ipx (needs kernel patch)
/proc/net/raw
/proc/net/raw6
/proc/net/tcp
/proc/net/tcp6
/proc/net/udp
/proc/net/udp6
/proc/net/unix
```

If /proc-based lsof says it can't identify the protocol for an open socket file, you may be able to identify the protocol yourself by using `grep` to look for the specific node number in the files of /proc/net -- e.g.,

```
$ grep <node_number> /proc/net/*
```

You may not be able to find the desired node number, because not all kernel protocol modules fully support /proc/net information.

If you find a matching node number in a /proc/net file that is not currently being processed by lsof, contact me via e-mail at <abe@purdue.edu>. I'll discuss adding support to /proc-based lsof for the protocol of the /proc/net file with you. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

The code that matches node numbers of open IPX protocol socket files to those in /proc/net/ipx requires Jonathan Sargent's Linux 2.1.79 patch to /usr/src/linux/net/ipx/af_ipx.c. The patch, suitable for input to Larry Wall's patch program, may be found in the lsof distribution file:

```
.../dialects/linux/proc/patches/net_ipx_af_ipx.c.patch
```

10.2.3 Why does /proc-based lsof warn about unsupported formats?

Lsof may issue the following warning:

```
lsof: WARNING: unsupported format: /proc/net/<file>
```

if the header line of the indicated <file> in /proc/net -- ax25, ipx, raw, tcp, udp, or unix -- doesn't match what lsof expects to find.

When the header line of a /proc/net file isn't what lsof expects, lsof probably can't parse the rest of the file correctly and doesn't try. As a result, lsof can't report

any NAME column information (e.g., local and remote addresses) for socket files bound to the indicated network protocol.

If you get this warning, please send me e-mail at <abe@purdue.edu>. Include the contents of the file lsof claims has an unsupported format. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?

The "(deleted)" notation following a path name in /proc-based lsof's NAME column comes from the /proc/<PID>/fd/<FD> entry for the open file. It's the Linux kernel's way of indicating the file is open but has been unlinked (rm'd).

10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?

/proc-based lsof can only report on processes whose /proc files it has permission to read. /proc normally grants permission to read all its files only to root or to the owning user ID.

Without permission to read most /proc files, lsof can only report full information for processes belonging to the user who is running lsof. /proc-based lsof may be able to report some information for all processes, depending on the permissions of their associated /proc files, but usually /proc-based lsof won't be able to access the files in /proc/<PID>/fd/ that describe regular open files.

If you want /proc-based lsof to report on all processes, you must install it with setuid-root permission.

10.2.6 Why won't Customize offer to change HASDCACHE or WARNDEVACCESS for /proc-based lsof?

/proc-based lsof doesn't read device information from /dev or the device cache file, so it makes no sense to change the state of device cache processing or /dev node accessibility warnings.

10.2.7 /proc-based lsof Linux NFS questions

10.2.7.1 Why can't lsof find files on an accessible NFS file system?

On occasion lsof may be unable to identify that an open file is on an NFS file system. This is most likely the

result of a bug in the way the Linux kernel supplies information to the reader of /proc/mounts (lsdf) -- sometimes that pseudo-file is truncated by the kernel.

One way to see if this is the case is to search for the NFS file system in /proc/mounts -- e.g.,

```
$ grep <NFS_file_system_mount_point> /proc/mounts
```

If you get no output or the third word of the output isn't "nfs", then lsdf won't consider the file system an NFS file system.

A second test is to look at the end of /proc/mounts -- e.g.,

```
$ tail /proc/mounts
```

If tail reports "# truncated" then /proc/mounts is incomplete because of a Linux kernel bug. The bug is documented at:

<http://www.xss.co.at/sysinfo/mounts.html>

The bug is fixed in Linux kernel 2.4.18, and possibly in some earlier Linux kernel versions.

10.2.7.2 Why can't lsdf find files on an inaccessible NFS file system?

If lsdf issues this message about a Linux file system, mounted from an NFS server:

```
lsdf: WARNING: can't stat() nfs file system /xxx/yyy
```

Then lsdf won't be able to find any open files on the file system.

That's because of an inadequacy in the Linux /proc file system. Its /proc/mounts file doesn't give the device doublet (major and minor numbers) of the file system as do many UNIX systems (e.g., Solaris). The only way lsdf can get the device doublet for a Linux file system is to call stat(2) on the file system path, which fails if the NFS server isn't accessible.

When lsdf doesn't know the device doublet of a file system, it can't find open files on the inaccessible file system, because it can't match the doublets of open files to the doublet of the inaccessible file system.

This topic is covered extensively in lsof(8) in its ALTERNATE DEVICE NUMBERS and BLOCKS AND TIMEOUTS sections.

10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?

The Linux /proc file system doesn't report socket options and values, socket states, and TCP options and values to lsof.

10.2.9 Does /proc-based Linux lsof use a device cache?

No. The Linux /proc/<PID>/fd/* entries provide device names to lsof via readlink(2). It is not necessary to enable device cache processing for /proc-based Linux lsof via the Customize script or modifications to the Linux machine.h header file.

10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values for its +fcfgGn option?

/proc-based lsof revisions 4.79 and above can only report some file structure values for Linux kernels below 2.6.22.

When running on Linux kernels at 2.6.22 and above lsof 4.79 can report some file flag values -- i.e., in response to the +fg or +fG options. The flag values are obtained from the /proc/<PID>/fdinfo/ files introduced at Linux kernel 2.6.22.

/proc-based Linux lsof tests its availability to obtain file flag values at initialization. If values are not available, lsof disables file flag reporting. If the flags were requested with +fg or +fG, lsof displays this warning:

```
lsof: WARNING: can't report file flags; disregarding +f.
```

As a special note, when Linux lsof can report flag bits, it will not report 'R' for a read-only file. There is no read-only flag bit O_* symbol in <fcntl.h> (or <bits/fcntl.h>) and lsof reports only bits that are set. The absence of O_RDWR and O_WRONLY flag bits implies the file is read-only.

10.3 Special Linux file types

10.3.1 Why is ``DEL" reported as a Linux file type?

Lsof usually reports entries from the Linux /proc/<PID>/maps file with ``mem" in the TYPE column. However, when lsof can't

stat(2) a path in the process' ``maps" file and the ``maps" file entry contains ``(deleted)", indicating the file was deleted after it had been opened, lsof reports the file type as ``DEL".

10.3.2 Why is ``unknown" reported as a Linux file type?

Lsof may report a Linux file's type as ``unknown" in the TYPE column when lsof can't obtain complete stat(2) results for the file.

Usually the NAME column will contain a ``(stat: xxx)" error message, but that could have been suppressed with the lsof ``-w" option.

10.4 Linux ``mem" Entry Problems

10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?

When the device or inode number in the process' ``maps" file entry doesn't match the stat(2) results from the file path, lsof reports the inconsistent information from the stat(2) of the path parenthetically after the path in the NAME column in one of these forms:

(path dev=xxx) only the device number,
``xxx", from a stat(2) of the
``maps" file entry path
differs from the ``maps" file
entry value reported in the
DEVICE column.

(path inode=yyy) only the inode number,
``yyy", from a stat(2) of the
``maps" file entry path
differs from the ``maps" file
entry value reported in the
NODE column.

(path dev=xxx inode=yyy) Both device and inode numbers
differ.

Lsof reports the ``maps" file device number in the DEVICE column and the inode number in the NODE column.

When device and inode mismatches occur, lsof suppresses the reporting of link count and size. See the answer to the "Why

is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?" question for more information.

Device and inode inconsistencies can occur when a file at a ``maps" path is replaced after the process has started, or when a different file system with similar path names is mounted on top of the original file system.

The device inconsistency parenthetical messages can be suppressed with lsof's ``-w" option.

10.4.2 Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?

Link count and size are not reported for some entries from the process' ``maps" file because a stat(2) of the entry file path failed or stat(2) delivered device or inode numbers that don't match the ones in the ``maps" entry.

When the stat(2) device or inode numbers don't match those in the ``maps" file entry, it is likely that the stat(2) results don't apply to the file that was originally mapped by the process and whose path appears in the ``maps" file entry, so lsof tries to avoid reporting possibly incorrect information.

See the answer to the "What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?" for more information on how mismatched stat(2) device and inode numbers are reported.

10.5 Special Linux NAME column messages

10.5.1 What does ``(stat: xxx)" mean in the NAME column of Linux files?

When lsof tried to stat(2) the path in the NAME column, the stat(2) system call failed and produced an error message of ``xxx".

This situation usually occurs if the lsof process lacks permission to stat(2) the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root_squash option.

The message can be suppressed with lsof's ``-w" option.

10.5.2 What does ``(readlink: xxx)" mean in the NAME column of Linux files?

When lsof tried to convert the `/proc/<PID>/fd` path, reported in the NAME column, to its full and more meaningful path, the `readlink(2)` system call used to do the conversion failed. The `readlink(2)` failure message is ```xxx"`.

This situation usually occurs if the lsof process lacks permission to `readlink(2)` some part of the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to `stat(2)` a path on an NFS device mounted with the `root_squash` option.

The message can be suppressed with lsof's ```-w"` option.

10.6 Why is ```NOFD"` reported as a Linux file type?

When lsof lacks permission to use `opendir()` on the `fd/` subdirectory of a process' `/proc/<PID>` directory, it reports a single file of the type ```NOFD"` (for no file descriptors).

Lsof reports the `/proc/<PID>/path` in the NAME column, followed by `"(opendir: xxx)"`, where ```xxx"` is the error message returned by `opendir()`.

The ```NOFD"` entry can be suppressed with lsof's ```-w"` option.

10.7 Why does Linux lsof report a NAME column value that begins with ```/proc"`?

When lsof has problems processing a ```/proc/<PID>"` entry -- e.g., it can't convert the entry to a full and more meaningful path name, or it can't access the `/proc/<PID>/fd` subdirectory with `opendir()` -- it will report the `/proc/<PID>` path in the NAME column.

10.8 Linux `/proc/net/tcp*` and `/proc/net/udp*` issues

10.8.1 Why use the Linux `-X` option?

If you're not interested in TCP/IP socket information for a particular use of lsof, adding the `-X` option will make lsof run more quickly, because `-X` inhibits the reading of the `/proc/net/tcp*` and `/proc/net/udp*` files. For example, you may only be interested in knowing what process has a particular file open.

When the Linux system has a large number of open TCP/IP socket files, the time savings provided by `-X` can be significant.

10.8.2 Why does lsof say ``-i is useless when -X is specified"?

If -X is specified, lsof can't report much information on open TCP/IP socket files. However, lsof's -i option requests that information. Hence, the two options conflict and can't be used together.

10.8.3 Why does lsof say ``can't identify protocol (-X specified)"?

If the Linux lsof -X option is specified and an open socket file can't be identified without accessing the /proc/net/tcp* and /proc/net/udp* files, lsof will report that it can't identify the socket's protocol and that the failure may be caused by the -X specification

11.0 NetBSD Problems

11.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open NetBSD kernfs files because the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

11.2 Why doesn't lsof report on open files on: file descriptor file systems; /proc file systems; 9660 (CD-ROM) file systems; MS-DOS (floppy disk) file systems; or kernel file systems?

Lsof is not able to report on open files on certain file system if /usr/src/sys/msdosfs didn't exist when the lsof Configure script ran and lsof was made. /usr/src/sys/msdosfs contains header files lsof needs for collecting data on certain file system files.

You can tell if an lsof executable above) lacks support for a file system if the following test of `lsof -v` produces nothing:

```
$ lsof -v 2>&1 | grep <support_enabled_definition>
```

The <support-enabled_definition> will be:

```
File System Type Definition Note
-----
File descriptor HASFDESCFS
/proc HASPROCFS
9660 HAS9660FS
```

MS-DOS HASMSDOSFS (Isuf 4.61 and above)
Kernel HASKERNFS

The work-around is to install /usr/src/sys, rerun the Isuf
Configure script, and remake Isuf.

11.3 Why does Isuf produce confusing results for nullfs file systems?

Consider this report from /sbin/mount:

```
/usr/home on /home type null (local)
```

(According to /sbin/mount /usr/home is the mounted-on device
and /home is the mounted-on directory.)

When Isuf is asked to report on open files on /home, it
will report them as files on /usr/home instead. That's an
artifact of the NetBSD kernel's dynamic name lookup cache
(DNLC) and the way the kernel handles nullfs mounted-on
directories.

While Isuf will report all open files on /home when given
/home as a file system directory argument, even though
reporting them as located on /usr/home, Isuf will not find
the same files when asked to report on all open files on
/usr/home when given /usr/home as a file system device
argument. That's because from the mount perspective
/usr/home is equivalent to a device, but from the device
perspective it is still a directory.

So, what this Isuf command reports:

```
$ Isuf /home  
... NAME  
... /usr/home/...
```

Won't be duplicated by this Isuf command:

```
$ Isuf /usr/home
```

Another way to look at this confusing /home and /usr/home
example is to consider what stat(2) reports. For /home
stat(2) reports a device doublet that matches what Isuf
finds in open file node structures, while the device doublet
stat(2) reports for /usr/home won't match what Isuf finds.
Nor does the mode reported by stat(2) indicate a block
devices, as is the expected case.

There is no simple answer to this confusion, nor is there even a simple explanation. Simply be aware that when supplying file system arguments to `lsnf` on NetBSD, use the mounted-on directory name for a nullfs as the `lsnf` argument, and don't be surprised when the `NAME` column reports the mounted-on device name.

11.4 NetBSD header file problems

11.4.1 Why can't the compiler find some NetBSD header files?

If the compiler's pre-processor complains it can't find some header files when it compiles `lsnf` source files, `/usr/include` and `/usr/src` may not have all the header files `lsnf` needs.

As a work-around use the `NETBSD_SYS` environment variable to specify to `lsnf` the location of the additional header files -- e.g.,

```
% setenv NETBSD_SYS /my_source
% ./Configure -n netbsd
```

or

```
$ NETBSD_SYS=/mys_source ./Configure -n netbsd
```

Caution: using this work-around may cause the `lsnf` `Configure` script to activate or omit different features, depending on where it finds the header files that determine the state of the features.

11.4.2 Why does NetBSD `lsnf` produce incorrect output?

If the NetBSD system's kernel was built from header files that don't match those in `/usr/include` -- e.g., `/usr/src` has the ones from which the kernel was built -- `lsnf` may build, but won't produce correct output.

As a possible work-around, try directing the C compiler to select header files from `/usr/src` before it selects them from `/usr/include`. That can be done with the `DEBUG` make string -- e.g.,

```
$ make DEBUG="-I/usr/src -I/usr/include"
```

If that work-around fails, try using the `LSOF_INCLUDE` and `NETBSD_SYS` environment variables to swap `/usr/include` and `/usr/src` when running the `Configure` script, then use the `make`

DEBUG string when running make -- e.g.,

```
$ LSOF_INCLUDE=/usr/src; export LSOF_INCLUDE
$ NETBSD_SYS=/usr/include; export NETBSD_SYS
$ ./Configure -n netbsd
$ make DEBUG="-I/usr/src -I/usr/include"
```

11.5 Why isn't lsof feature xxx enabled for NetBSD?

Lsof's Configure script enables NetBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See 00PORTING for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

Lsof normally looks for NetBSD header files in /usr/include. It can also be directed to look in other directories -- e.g., /sys -- if told to do so with the contents of the LSOF_INCLUDE and NETBSD_SYS environment variables.

To determine what header file enables a missing feature, check the NetBSD stanza in the Configure script. Then check the locations it checks for the indicated header files and contents.

See 00XCONFIG for more information on LSOF_INCLUDE and NETBSD_SYS.

12.0 NEXTSTEP and OPENSTEP Problems

12.1 Why can't lsof report on 3.1 lockf() or fcntl(F_SETLK) locks?

Lsof has code to test for locks defined with lockf() or fcntl(F_SETLK) under NEXTSTEP 3.1, but that code has never been tested. I couldn't test it, because my NEXTSTEP 3.1 lockf() and fcntl(F_SETLK) functions return "Invalid argument" every way I have tried to invoke them.

If your NEXTSTEP 3.1 system does allow you to use lockf() and fcntl(F_SETLK) and lsof doesn't report locks set with them, then the code in ../dialects/next/dnode.c probably isn't correct. Please contact me via e-mail at <abe@purdue.edu> and tell me how you got your lockf() and fcntl(F_SETLK) system

calls to work. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

12.2 Why doesn't lsof compile for NEXTSTEP with AFS?

I no longer have a NEXTSTEP test system that has AFS. Changes to lsof since I once had a test system have caused me to change the AFS code in NEXTSTEP without being able to test the changes.

If you need AFS support for NEXTSTEP and can't get it to compile, please contact me. Perhaps we can jointly fix the problems.

13.0 OpenBSD Problems

13.1 Why doesn't lsof support kernfs on my OpenBSD system?

Lsof supports the kernel file system on OpenBSD versions whose `/sys/miscfs/kernfs/kernfs.h` (or `<miscfs/kernfs/kernfs.h>` header file correctly defines the `kern_target` structure. The lsof Configure script's `openbsd` stanza checks for the presence of the structure's `kt_name` element and activates kernfs support for the `CFLAGS -DHASKERNFS` definition only when it finds `kt_name`.

The `kernfs.h` header file is scheduled to be updated in the OpenBSD 2.1 release, according to Kenneth Stailey, who authored its changes.

13.2 Will lsof work on OpenBSD on non-x86-based architectures?

I've not tested lsof on an OpenBSD system that uses a non-x86-based architecture, but I've had one report that lsof 4.33 compiles and works on OpenBSD for the `pmax` architecture (decstation 3100).

13.3 `<sys/pipe.h>` problems

13.3.1 Why does the compiler claim `nbp` isn't defined?

When compiling lsof on some (older) OpenBSD SPARC versions, the compiler may complain:

```
In file included from ../dlsof.h:191,  
from ../lsof.h:166,  
from fino.c:52:
```

```
/usr/include/sys/pipe.h:83: `nbpq' undeclared here
(not in a function)
/usr/include/sys/pipe.h:83: size of array `ms' has
non-integer type
```

This happens because `<sys/pipe.h>` uses NBPG from `<machine/param.h>` to size the ``ms'` array, and some OpenBSD systems define NBPG in terms of a kernel integer variable, `nbpq`.

Lsof revisions 4.46 and above have a hack to `dlsof.h`, developed by Volker Borchert that avoids the compiler problem for SPARC OpenBSD 2.3. The hack might work for other OpenBSD SPARC versions, but hasn't been tested there.

If you want to enable the hack for your OpenBSD SPARC version, modify this code in `.../dialects/n+obsd/dlsof.h`:

```
# if defined(OPENBSDV)
# if OPENBSDV==2030 && defined(__sparc__)
# if defined(nbpq)
#undef nbpq
# endif /* defined(nbpq) */
#define nbpq 4096 /* WARNING!!! ... */
# endif /* OPENBSDV==2030 && defined(__sparc__) */
#include <sys/pipe.h>
#endif /* defined(OPENBSDV) */
```

You will probably want to change the second `#if` test to match your OpenBSD version. You may also want to change what value is assigned to `nbpq`. See the next section, "What value should I assign to `nbpq`?"

13.3.2 What value should I assign to `nbpq`?

If you need to enable the `nbpq` hack, described in "Why does the compiler claim `nbpq` isn't defined?", you may also need to assign a value other than 4096 to `nbpq`. 4096 works for the sun4c processor and should work for sun4m, but 8192 may be needed for sun4.

Check `<machine/param.h>` and other OpenBSD documentation to determine the correct `nbpq` assignment.

13.4 Why doesn't lsof report on open MS-DOS file system (floppy disk) files?

Lsof is not able to report on open MS-DOS file system files

if `/usr/src/sys/msdosfs` didn't exist when the `lsof` Configure script ran and `lsof` was made. `/usr/src/sys/msdosfs` contains header files `lsof` needs for collecting data on MS-DOS file system files.

You can tell if an `lsof` executable (revisions 4.61 and above) lacks MS-DOS file system support if the following command reports nothing:

```
$ lsof -v 2>&1 | grep HASMSDOSFS
```

The work-around is to install `/usr/src/sys`, rerun the `lsof` Configure script, and remake `lsof`.

13.5 Why isn't `lsof` feature xxx enabled for OpenBSD?

`lsof`'s Configure script enables OpenBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See `00PORTING` for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree `lsof` is searching is incomplete or out of date.

`lsof` normally looks for OpenBSD header files in `/usr/include` and `/sys`. It can also be directed to look in other directories if told to do so with the contents of the `LSOF_INCLUDE` and `NETBSD_SYS` environment variables.

To determine what header file enables a missing feature, check the OpenBSD stanza in the Configure script. Then check the locations it checks for the indicated header files and contents.

See `00XCONFIG` for more information on `LSOF_INCLUDE` and `NETBSD_SYS`.

14.0 Output Problems

14.1 Why do the `lsof` column sizes change?

`lsof` dynamically sizes its output columns each time it runs to make sure that each column takes the minimum space. Column parsing -- e.g., with `awk` -- is possible, because each column is guaranteed to be separated from the preceding one by at least one space, and no column except the last

(NAME) contains embedded spaces.

14.2 Why does the offset have ``0t' and ``0x" prefixes?

The offset value that appears in the SIZE/OFF column has ``0t' and ``0x" prefixes to distinguish it from size values that may appear in the same column.

Normally if the offset value is less than 100,000,000 (8 digits), it appears in decimal with a ``0t' prefix; over 99,999,999, in hexadecimal with a ``0x" prefix.

A decimal offset is handy, for example, when tracking the progress of an outbound ftp transfer. When lsof reports on the ftp process, it will report the size of the file being sent with its open descriptor; it will report the progress of the transfer via the offset of the outbound open ftp data socket descriptor.

The ``-o [n]" option may be used to specify the maximum number of decimal digits to be printed after ``0t" before lsof switches to the hexadecimal digits after ``0x". As already noted, the default decimal digit count is 8.

14.3 What are the values printed in the FILE_FLAG column and why is 0x<value> sometimes included?

The two comma separated lists, separated by a semicolon, printed in the FILE-FLAG column (when the "+fg" option is specified), are short-hand names or hexadecimal values for the bits lsof finds in the f_flag or f_flags member of file structures for files (the first list, the one before the semicolon), and process open files flags found in various kernel structures, often named "pofile" (the second list, the one after the semicolon).

Lsof determines the short-hand names from symbols in the <fcntl.h>, <linux/fs.h>, <sys/fcntl.h>, <sys/fcntlcom.h>, <sys/file.h>, and <sys/user.h> header files.

See the discussion of FILE-FLAG in the OUTPUT section of the lsof man page, and the FF_* and POF_* symbols in lsof.h for a list of the names.

Bits with no names defined for them are represented by an 0x<value> member of the comma-separated list -- a hexadecimal integer. When "+fG" is specified (instead of "+fg"), lsof will list all flag values as two hexadecimal integers,

separated by a semicolon.

When "-FG" is specified to get the flags in an output field, the format defaults to hexadecimal. You can get names instead by following "-FG" with "+fg" -- e.g.,

```
$ lsof -FG +fg ...
```

However, when you precede "-FG" with "+fg" -- e.g.,

```
$ lsof +fg -FG
```

the format will be hexadecimal; order is important.

14.3.1 Why doesn't lsof display FILE_FLAG values for my dialect?

All versions of lsof except the /proc-based Linux lsof report FILE-FLAG values. Lsof can't obtain FILE-FLAG information from the Linux /proc interface.

14.4 Network Addresses

14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

When you use the -n option to tell lsof to display numeric network addresses, and an IPv4 address has been mapped to IPv6, lsof displays the address in IPv6 format and puts "ipv4" in the TYPE column. That combination indicates the IPv4 address has been mapped to IPv6.

For example, the IPv4 address 1.2.3.4, when mapped to an IPv6 address, will be displayed by lsof as:

```
[::ffff:1.2.3.4]
```

The enclosing brackets are lsof's signal that this is an IPv6 address. Inside the brackets is a standard IPv6 address, reported by inet_ntop(). The first two colons, signifying zeroes in the first 64 bits of the IPv6 address, and the hexadecimal ffff in the next 32 bits, indicate that the last 32 bits contains a mapped IPv4 address, which is then displayed in IPv4 dot notation.

14.5 Why does lsof output \x, ^x, or \xnn for characters sometimes?

Lsof displays only printable ASCII characters. Lsof

considers a character printable if `isprint(3)` says it is. If `isprint(3)` says a character isn't printable, the `lsf` man page explains:

"... Non-printable characters are printed in one of three forms: the C `\\[bfrnt]` form; the control character `^'` form (e.g., `^^@`); or hexadecimal leading `\\x` form (e.g., `\\xab`). Space is non-printable in the COMMAND column (`\\x20`) and printable elsewhere."

14.5.1 Why is space considered a non-printable character in command names?

Space is considered an unprintable character in command names because it is sometimes possible to hide the full command name from scripts that parse `ps(1)` output by embedding a space in the name.

14.6 Why doesn't `lsf` print all the characters of a command name?

By default `lsf` prints the first nine characters of the names of commands associated with processes. If more characters are required, the "w" value of the "+c w" option may be used to specify a larger width.

If "w" is zero (0) `lsf` will print all characters of all command names up to the limit of the number of characters supplied by the particular UNIX dialect. When reporting command names, `lsf` replaces non-printable characters as discussed in the answer to "Why does `lsf` output `\\x`, `^x`, or `\\xnn` for characters sometimes?"

See the answer to the "Why is space considered a non-printable character in command names?" question for an explanation of why spaces are replaced by the `\\x20` representation in command names.

The number of command name characters supplied to `lsf` by UNIX dialects in files and structures varies by dialect. For example, Linux 2.4.27 supplies `lsf` the first 15 characters of command names and Solaris 9 supplies 16. Thus, even if "w" is zero (0), `lsf` can't report more characters for command names on those two UNIX dialects than they provide `lsf`.

14.7 Why does `lsf` reject some -c command names, saying their lengths are "> what system provides (nn)"?

The command name length that a specific system provides varies from dialect to dialect. As noted in the answer to the "Why doesn't lsof print all the characters of a command name?" question, Linux and Solaris provide a limited number of command name characters.

When more characters are specified in the parameter to the -c option, lsof considers it an error and issues a fatal error message -- e.g.,

lsof: "-c xxxxyyyy" length (8) > what system provides (7)

The only work-around is to specify no more characters to -c than the system provides to lsof.

14.8 Why does lsof sometimes print TYPE numbers instead of names?

When lsof can't convert a type number to a name for printing in the TYPE column, it will report the number as four octets.

14.9 Marker line format problems

14.9.1 Why won't lsof accept a marker line format?

Lsof's Configure script must find the localtime(3) and strftime(3) functions in the dialect's C library in order to enable support for marker line formats.

Check the output of lsof's -v option for the presence of -DHAS_STRFTIME in the compiler flags. If it isn't there, Configure didn't find the necessary two C library functions.

If you think lsof should have found the functions, make a copy of the C test program in the Configure script that it uses to find the functions. Then use the copy, or a more informative modification of it, to learn why Configure can't find the functions. You can find that program by searching for strftime.

14.9.2 Why does lsof reject the NL (%n) marker line format?

When repeat mode and field output (with -F) have both been specified, lsof won't allow new line (NL) formats to be specified with ``%n". That's because the marker line is always guaranteed to be a single line.

There is no work-around to this restriction.

14.10 How are protocol state name exclusion and inclusion used?

Protocol state name inclusion and exclusion with the ``-s p:s" option and its arguments have some issues to consider.

First, there is the problem of determining what state names, if any, the dialect produces. Try running this lsof command to find them:

```
$ lsof -i
```

Knowing the state names of interest, the next problem is to decide on the lsof options and their parameters that will produce the desired output. Here some examples are probably the most useful.

To list only TCP socket files in LISTEN and CLOSE_WAIT states, use:

```
$ lsof -itcp -stcp:listen,close_wait  
or  
$ lsof -iTCP -sTCP:LISTEN,CLOSE_WAIT
```

Case isn't important to lsof in protocol and state names.

To exclude TCP socket files in CLOSE_WAIT state, use:

```
$ lsof -itcp -stcp:^close_wait
```

Note the `^' preceding close_wait; it selects exclusion. You can mix included and excluded names in a comma separated list, but you may not include and exclude the same name for the same protocol.

To list TCP files in LISTEN state and UDP files in Idle state, use:

```
$ lsof -i -stcp:listen -sudp:idle
```

Note: if you don't accompany the ``-s p:s" list option and arguments with the -i option, lsof will list all other regular files, while applying the specified inclusion and exclusion specifications to network files. Generally, then, you want to use -i with -s.

14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

When state name inclusion and exclusion was added, I had access

to test systems for AIX, Darwin, FreeBSD, Linux, PSTAT-based HP-UX and Solaris.

Therefore, I was unable to add and test the support to any other UNIX dialects.

If a dialect has the support, then the HASTCPUDPSTATE definition in its machine.h header file will be active; if not, it will be absent or commented out.

If your dialect doesn't have the support and you want it added, you will have to provide me Internet access to a test host, where I can compile lsof and have the credentials to test the changes the support requires. If that's possible for you, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

15.0 Pyramid Version Problems

15.0.5 Statement of deprecation

As of lsof revision 4.52 support for all Pyramid versions has been dropped. Contact me via e-mail at <abe@purdue.edu> if you are interested in obtaining the last lsof Pyramid distribution. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

16.0 SCO Problems

16.1 SCO OpenServer Problems

16.1.1 How can I avoid segmentation faults when compiling lsof?

If you have an older SCO OpenServer compiler, it may get a segmentation fault when compiling some lsof modules. That appears to happen because of the -Ox optimization action requested in the lsof Makefile.

Try changing -Ox to -O with this make invocation:

```
$ make DEBUG=-O
```

Bela Lubkin supplied this tip and Steve Williams verified it.

16.1.2 Where is libsocket.a?

If you compile lsof and the loader says it can't find the socket library, libsocket.a, called by the -lsocket option in the lsof compile flags, you probably are running an SCO OpenServer release earlier than 5.0 and don't have the TCP/IP Development System package installed.

You may have the necessary header files, because you have the TCP/IP run-time package installed, but if you don't have the TCP/IP Development System package installed, you won't have libsocket.a.

Your choices are to install the TCP/IP Development System package or upgrade to OpenServer Release 5.0. You will find libsocket.a in 5.0 -- you'll find all the libraries and header files there, in fact -- and you can use gcc to compile lsof if you don't want to install the 5.0 Development System package.

16.1.3 Why do I get "warning C4200" messages when I compile lsof?

When you compile lsof under OSR 3.2v4.2 (and perhaps under earlier versions as well), you may get many compiler warning messages of the form:

```
node.c(183) : warning C4200: previous declarator is not
compatible with default argument promotion
```

In my opinion this is a bug in the OSR compiler. Because the compiler cannot handle full ANSI-C prototypes, it assumes default types for function parameters as it encounters untyped in a function prototype -- e.g., in this function declaration from node.c,

```
readrnode(ra, r)
KA_T ra;
struct rnode *r;
{
...

```

the compiler assigns default int types to the ra and r arguments.

Then, when the compiler encounters the fully typed parameters after the function skeleton and sees parameters with types that don't match the assumptions it previously made, it whines about its own assumptions.

You can ignore these messages.

16.2 SCO|Caldera UnixWare Problems

16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

When you Configure lsof with the "uw" abbreviation and try to compile it for UnixWare 7.1.1, you may get compiler error messages like this:

```
UX:acomp: ERROR: "dproc.c", line 98:  
undefined struct/union member: p_pgidp
```

This suggest that you probably have a non-stop cluster UnixWare 7.1.1 system. Its <sys/proc.h> header file differs from the one on the system where I did the lsof port to UnixWare 7.1.1. I currently don't have access to a non-stop cluster system to be able to develop changes to lsof that would make it compile and work there.

If you have a non-stop cluster UnixWare 7.1.1 system, want lsof for it, and can offer me a test account on the system, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

If you have a system with nsc_cfs and can offer me a test account on it, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

16.2.2 Why does lsof complain about node_self() on my UnixWare 7.1.1 or above system?

If lsof exits immediately after issuing this message:

```
can't identify process NSC node; node_self(): <message>
```

It means that lsof has been built to run on a NonStop Cluster (NSC) UnixWare 7.1.1 or higher system and can't get the number of the node on which it is running. Lsof uses the node number to determine the path to the kernel boot file.

You can tell if lsof has been built for NSC by looking for "-DHAS_UW_NSC" in lsof's "-v" option output.

If the system on which you're trying to run lsof isn't running an NSC kernel, you will need to build a non-NSC lsof.

16.2.3 Why does UnixWare 7.1.1 or above complain about -lcluster, node_self(), or libcluster.so?

When you build, compile, and load lsof for UnixWare 7.1.1 and above, ld may complain that it can't find the -lcluster library or that the node_self symbol is undefined. When you try to run an existing lsof binary it may complain that libcluster.so can't be found.

These messages mean the tests made by Configure on your system led it to believe your system is running a NonStop Cluster (NSC) kernel, or the lsof binary you're trying to use was built on a NonStop Cluster system. If an lsof binary was built for NSC, this shell command produces output:

```
$ strings <lsof_binary> | grep HAS_UW_NSC
```

If that's not the case, and you can rebuild lsof, set the UW_HAS_NSC environment variable to "N" and do this:

```
$ Configure -n clean
$ UW_HAS_NSC=N
$ export UW_HAS_NSC
$ Configure -n uw
$ make
```

You can also edit Makefile and lib/Makefile. Remove -DHAS_UW_NSC from the CFGF strings. Remove -lcluster from the CFGL strings. Then run make again.

If you have an existing NSC lsof binary and you want one for a non-NSC system, you will have to build lsof yourself on the system where you want to use it. (That's always a good idea anyway.)

16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?

If lsof complains:

```
can't read kernel name list from <path>
```

It means that lsof can't find the booted kernel image file at <path>. On NonStop Cluster (NSC) UnixWare 7.1.1 or higher systems lsof determines the booted file path by examining this file:

```
/stand/node_self/boot
```

If examining that file doesn't lead to an NSC path, lsof uses:

```
/stand/1/unix
```

On non-NSC systems lsof expects the booted kernel image to be in /stand/unix.

If your booted kernel image is in a different place, use lsof's "-k <path>" option to specify its path.

16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?

Lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the node where lsof runs, so lsof cannot report them.

16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?

Lsof can only report on files open on the node on which it runs, because the information lsof reports comes from the private kernel memory of the node. This may mean that asking lsof to find a specific open file, or use of a specific Internet address or port, may not report all open instances on nodes other than the one used to run lsof.

You can use the NSC onnode(1) command to run lsof on specific nodes, or the onall(1) command to run lsof on all nodes -- e.g.,

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

Note that, when lsof is run all nodes, the path name component assembly results it reports in its NAME column may vary, because the dynamic name cache from which lsof

gets the components is private to the kernel of each node.

Also note the use of shell redirection in the examples to merge the standard error file information from onnode and onall with lsof's standard output file output. That will put the onnode and onall node announcements in proper sequence with lsof's output.

16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster (NSC) node a process is using?

To induce lsof to report the node on which a process runs would be a significant, non-standard modification to lsof. It has much wider implications than merely the printing of a number in an output column. I'm not currently (April 2001) prepared to undertake such a modification.

If you want node-specific NSC information about open files, run lsof under the control of onall(1) or onnode(1).

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

SCO|Caldera didn't ship the following header files with UnixWare 2.1 through 2.1.3:

```
<fs/proc/prdata.h>  
<fs/procfs/prdata.h>  
<sys/fs/fifonode.h>  
<sys/fs/namenode.h>
```

Lsof needs those header files for its compilation. Contact SCO|Caldera to get copies of those header files.

If you can't get the header files from SCO|Caldera, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

17.0 Sun Problems

17.0.5 Statement of deprecation

Lsof support for SunOS 4.1.x was last tested at revision 4.51.
Contact me via e-mail at <abe@purdue.edu> if you're interested in
obtaining it. Make sure "lsof" appears in the "Subject:" line so
my e-mail filter won't classify your letter as Spam.

17.1 My Sun gcc-compiled lsof doesn't work -- why?

Gcc can be used to build lsof successfully. However, an
improperly installed Sun gcc compiler will usually not
produce a working lsof.

If your Sun gcc-compiled lsof doesn't report anything, or
reports ``can't read proc table," or gcc refuses to compile
lsof without error, check that the gcc step that "fixes"
Sun header files was run on the system where you're using
gcc to compile lsof. As an alternative, if you have the
SunPro C 5.0 compiler or later available, use it to compile
lsof -- e.g., use the solariscc Configure abbreviations.

17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Presuming your gcc-specific header files are wrong for
Solaris, edit the lsof Configure-generated Makefile and
lib/Makefile and make this change:

```
CFGF= -Dsolaris=20400 ...  
to  
CFGF= -Dsolaris=20400 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20500 ...  
to  
CFGF= -Dsolaris=20500 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20501 ...  
to  
CFGF= -Dsolaris=20501 -D__STDC__=0 -I/usr/include ...
```

This is only a temporary work-around. You really should
instruct gcc to update your gcc-specific header files
or install a recent gcc (e.g., 3.2), which has no need for
private copies of Solaris include files.

17.3 Why does Solaris Sun C complain about system header files?

You're probably trying to use `/usr/ucb/cc` if you get compiler complaints like:

```
cc -O -Dsun -Dsolaris=20300 ...
"/usr/include/sys/machsigsig.h", line 81: macro BUS_OBJERR
redefines previous macro at "/usr/ucbinclude/sys/signal.h",
line 444
```

Note the reference to `"/usr/ucbinclude/sys/signal.h"`. It reveals that the BSD Compatibility Package C compiler is in use. `lsf` requires the ANSI C version of the Solaris C compiler, usually found in `/usr/opt/bin/cc` or `/opt/SUNWspro/bin/cc`.

Try adding a `CC` string to the `lsf` Makefile that points to the Sun ANSI C version of the Sun C compiler -- e.g.,

```
CC= /usr/opt/bin/cc
or
CC= /opt/SUNWspro/bin/cc.
```

17.4 Why doesn't `lsf` work under my Solaris 2.4 system?

If `lsf` doesn't work under your Solaris 2.4 system -- e.g., it produces no output, little output, or the output is missing command names or file descriptors -- you may have a pair of conflicting Sun patches installed.

Solaris patch 101945-32 installs a kernel that was built with a `<sys/auxv.h>` header file whose `NUM_*_VECTORS` definitions don't match the ones in the `<sys/auxv.h>` updated by Solaris patch 102303-02.

`NUM_*_VECTORS` in the kernel of patch 101945-32 are smaller than the ones in the `<sys/auxv.h>` of patch 102303-02. The consequence is that when `lsf` is compiled with the `<sys/auxv.h>` whose `NUM_*_VECTORS` definitions are larger than the ones used to compile the patched kernel, `lsf`'s user structure does not align with the one that the kernel employs.

If you have these two patches installed, contact Sun and complain about the mis-match.

You may be able to work around the problem by editing `/usr/include/sys/auxv.h` to have the following `NUM_*_VECTORS` definitions:

```
#define NUM_GEN_VECTORS 4
#define NUM_SUN_VECTORS 8
```

The Configure script issues a prominent WARNING that you should try the work-around.

I thank Leif Hedstrom for identifying the offending patches.

17.5 Where are the Solaris header files?

If you try to compile lsof under Solaris and get a compiler complaint that it can't find system header files, perhaps you forgot to add the header file package, SUNWhea.

17.6 Where is the Solaris /usr/src/uts/<architecture>/sys/machparam.h?

When you try to Configure lsof for Solaris 2.[23456], 2.5.1, and 7 -- e.g., on a `uname -m` == sun4m system -- Configure complains:

```
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
```

And when you try to compile the configured lsof, cc or gcc complains:

```
dproc.c:530: `KERNELBASE' undeclared (first use this function)
```

The explanation is that somehow your Solaris system doesn't have the header files in /usr/src/uts it should have. Perhaps someone removed the directory to save space. Perhaps you're using a gcc installation, copied from another system. In any event, you will have to load the header files from the SUNWhea package of your Solaris distribution.

KERNELBASE is an important symbol to lsof -- it keeps lsof from sending an illegal kernel value to kvm_read() where a segmentation violation might result (a bug in the kvm library). Lsof can get illegal kernel values because it reads kernel values slowly with kvm_read() calls that the kernel is changing rapidly.

Lsof doesn't need KERNELBASE at Solaris 2.5 and above, because it has a KERNELBASE value whose address lsof can find with /dev/ksyms and whose value it can read with kvm_read(). Under Solaris 2.5 /usr/src/uts has moved to

/usr/platform.

17.7 Why does Solaris lsof say "can't read proc table"?

When lsof collects data on processes, using the `kvm_*()` functions to scan the kernel's proc structure table, it checks to make sure it has identified a reasonable number of them -- a minimum of three. When lsof can't identify three processes during a scan, it repeats the scan.

When five scans fail to yield three processes, lsof issues the fatal message:

```
lsof: can't read proc table
```

and exits.

Usually lsof fails to identify three processes during a scan because its idea of the form of the proc structure differs from that being used by the kernel. Since the proc structure is defined in `<sys/proc.h>` and other `/usr/include` header files, the root cause of a proc structure discrepancy usually can be found in the composition of `/usr/include`.

One common way that `/usr/include` header files can be incorrect is that gcc was used to compile lsof, gcc used its special (i.e., "fixed") header files instead of the ones in `/usr/include`, and the special gcc header files weren't updated when Solaris was. Answers to these questions:

My Sun gcc-compiled lsof doesn't work -- why?

How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Why does Solaris Sun C complain about system header files?

discuss the gcc header file problem and offer suggestions on how to fix it or work around it.

It may also be that you are trying to run a version of lsof that was compiled on an older version of Solaris. For example, an lsof executable, compiled for Solaris 2.4, will produce the "can't read proc table" message if you try to run it under Solaris 2.5. If you have compiled lsof under Solaris 2.5 and it still won't work, see if the header files in `/usr/include` have been updated to 2.5, or still represent a previous version of Solaris.

Another source of header file discrepancies to consider is the Solaris patch level and whether a binary kernel patch was not matched with a corresponding header file update. See the "Why doesn't lsof work under my Solaris 2.4 system?" question for an example of one in Solaris 2.4 -- there may be other such patch conflicts I don't know about.

17.8 Why does Solaris lsof complain about a bad cached clone device?

When lsof revisions below 4.04 have been run on a Solaris system and have been allowed to create a device cache file, the running of revisions 4.04 and above on the same systems may produce this complaint:

```
lsof: bad cached clone device: ...  
lsof: WARNING: created device cache file: ...
```

This is the result of a change in the device cache file that took place at lsof revision 4.04. The change introduced a node number into the clone device lines of the device cache file and was done in such a way that lsof could detect device cache files whose clone lines don't have node numbers (lines created by previous lsof revisions) and recognize the need to regenerate the device cache file.

17.9 Why doesn't Solaris make generate .o files?

Solaris /usr/ccs/bin/make won't generate .o files from .c files if /usr/share/lib/make/make.rules is missing. It may be found in and installed from the SUNWsport package.

17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N'?

For Solaris 2.3 with patch P101318 installed at level 45 or above, and for all versions of Solaris 2.4, NFS locks are represented by a NFS-specific kernel lock structure that sometimes lacks a read or write lock type indicator. When lsof encounters such a lock structure, it reports the lock type as `N'.

17.11 Why does lsof Configure say "WARNING: no cc in ..."?

When lsof's Configure script is executed with the solariscc abbreviation it tries to make sure it's using the Sun C compiler and not the UCB substitute from /usr/ucb/cc. Thus, it looks for cc in the "standard" Sun compiler location, /opt/SUNWspro/bin.

If Configure can't find cc there, it issues the warning:

```
lsof: WARNING: no cc in /opt/SUNWspro/bin;  
using cc without path.
```

and uses cc for the compiler name, letting the shell find cc with its PATH environment variable.

You can tell Configure where to find your cc with the SOLARIS_CC_DIR cross-configuration environment variable. (See 00XCONFIG for more information on SOLARIS_CC_DIR). For example, use this Configure shell command:

```
SOLARIS_CC_DIR=/usr/special/bin Configure -n solariscc
```

(SOLARIS_CC_DIR should be the full path to the directory containing your cc.)

17.12 Solaris 7, 8 and 9 Problems

17.12.1 Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?

Solaris 7, 8 and 9 kernels come in two flavors, 32 and 64 bit. 64 bit kernels run on machines that support the SPARC v9 instruction set architecture. Separate executables for some programs, -- e.g., ones using libkvm like lsof -- must be built for 32 and 64 bit kernels.

Previous Sun (e.g., SC4.0) and earlier gcc compilers will build lsof for 32 bit kernels, but they won't build it for 64 bit kernels. Compilers that will build lsof for 64 bit Solaris 7, 8 and 9 kernels are the Sun WorkShop Compilers C 5.0 and above, and recent gcc versions, e.g., 3.2.

When given the "-xarch=v9" flag, the C 5.0 compiler and above, and associated loader and 64 bit libraries will build a 64 bit lsof executable; when given the "-m64" or "-mcpu=v9" (deprecated) flags, an appropriate gcc compiler will build a 64 bit lsof executable.

When the lsof Configure script detects a 64 bit kernel is in use (e.g., by executing `/bin/isainfo -kv`), and when it finds that the specified compiler is inappropriate, it complains with these messages:

For gcc:

```

"!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!"
"!                               !"
"! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT !"
"! THIS GCC DOESN'T SUPPORT THE BUILDING OF 64 BIT    !"
"! SOLARIS EXECUTABLES. LSOF WILL BE CONFIGURED FOR A !"
"! 32 BIT echo KERNEL.                               !"
"!                               !"
"!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!"

```

For Sun C:

```

!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
!                               !
! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT |
! THE VERSION OF SUN C AVAILABLE DOESN'T SUPPORT THE   !
! -xarch=v9 FLAG. LSOF WILL BE CONFIGURED FOR A 32 BIT !
! KERNEL.                                             !
!                               !
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!

```

17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled for..."?

Solaris 7, 8 or 9 lsof may say:

```

lsof: FATAL: lsof was compiled for a xx bit kernel,
but this machine has booted a yy bit kernel.

```

```

Where: xx = 32 or 64
yy = 64 or 32

```

(xx and yy won't match.)

This message indicates that lsof was compiled for one size kernel and is being asked to execute on a different size one. That's not possible for programs like lsof that use libkvm.

Depending on the instruction sets for which you need Solaris 7, 8 or 9 lsof, you may need two or more versions of lsof, compiled for each kernel size, installed for use with /usr/lib/isaexec. See the "How do I install lsof for Solaris 7, 8 or 9?" section of this document for more information on that.

17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?

If your Solaris system has an appropriate compiler (e.g., WorkShop Compilers C 5.0 and above, or a recent gcc like 3.2) and the 64 bit libraries have been installed, you can force lsof's Configure script to build a 64 bit version of lsof with:

```
$ SOLARIS_KERNBITS=64 Configure -n solarisc
```

The SOLARIS_KERNBITS environment variable is part of the lsof cross-configuration support, described in the 00XCONFIG file of the lsof distribution.

17.12.4 How do I install lsof for Solaris 7, 8 or 9?

If you are installing lsof where it will be used only under the bit size kernel for which it was built, no special installation is required.

If, however, you are installing different versions of lsof for different bit sizes -- e.g., for use on a 64 bit NFS server and from its 32 bit clients -- you should read the man page for isaexec(3C) and install lsof according to its instructions.

The executable at the directory where lsof is to be found should be a hard link to /usr/lib/isaexec or a copy of it. In the directory there must be instruction architecture subdirectories -- e.g., ../sparc/ and ../sparcv9/. The lsof for 64 bit size kernels is installed in the ../sparcv9/ subdirectory; the one for 32 bit size kernels, in ../sparc/.

For example, if you're installing 32 and 64 bit lsof executables in /usr/local/etc, you would:

```
# cd /usr/local/etc
# ln /usr/lib/isaexec lsof
# mkdir sparc sparcv9
# install the 32 bit lsof as sparc/lsof
# install the 64 bit lsof as sparcv9/lsof
# chmod, chown, and chgrp sparc/lsof and
  sparcv9/lsof appropriately
```

Lsof permissions and ownerships are the same whether one or more lsof executables are being installed, with or without the /usr/lib/isaexec hard link.

17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute

lsf?

When you attempt to execute lsf, your Solaris 7, 8 or 9 shell may complain:

```
ksh: ./lsf: cannot execute
```

If the lsf executable exists and has the proper execution permissions, this error may be the result of trying to execute an lsf, built for a 64 bit kernel, on a 32 bit kernel.

This will tell you about the lsf executable:

```
$ file lsf
lsf: ELF 64-bit MSB executable SPARCV9 Version 1,
dynamically linked, not stripped
```

The "64-bit" notation indicates the binary was built for a 64 bit kernel. To see the running kernel bit size, use this command:

```
$ isainfo -kv
32-bit sparc kernel modules
```

The "32-bit" notation indicates a 32 bit kernel has been booted.

The only work-around is to obtain, or Configure and make, an lsf for the appropriate kernel bit size. If you Configure and make lsf on the kernel where you wish to run it the proper compiler, the lsf Configure step will generate Makefiles that can be used with make to build an appropriate lsf executable.

To compile a 64 bit lsf, you must have an appropriate compiler -- i.e., Sun WorkShop Compilers C 5.0 or higher or a recent gcc like 3.2.

17.12.6 What gcc will produce 64 bit Solaris 7, 8 and 9 executables?
8 and 9 executables?

Properly built and installed recent gcc versions -- e.g., 3.2 -- will build lsf for 64 bit Solaris kernels.

If you update your gcc version to 3.2 or later, make sure the private gcc header files become current -- i.e., clear out any private header files from a previous gcc or Solaris

installation before installing the new ones, or build to a new --prefix root and replace the old root with it after the build and installation are complete.

17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms?"

You're probably trying to use an lsof executable built for an earlier Solaris release on a 64 bit Solaris 7, 8 or 9 kernel. The output from `lsof -v` will tell you the build environment of your lsof executable. You should also have gotten a warning message that lsof is compiled for a different Solaris version than the one under which it is running -- something like this:

```
lsof: WARNING: compiled for Solaris release X; this is Y
```

You need to build lsof on the system where you want to use it. For 64 bit Solaris 7, 8 and 9 you need a compiler that can generate 64 bit Solaris executables -- e.g., the Sun Workshop 5 C compiler or later, or a recent gcc version like 3.2. See the "Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?" section and the ones following it for a discussion of building lsof for 64 bit Solaris 7, 8 or 9.

17.13 Solaris and COMMON

17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?

When lsof puts COMMON or (COMMON) in the NAME column of a Solaris VCHR file, it means that the file is handled by the special file system functions of the kernel through a common vnode.

17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?

When lsof reports on an open file in a Solaris special file system that uses a COMMON vnode, and the file is a VCHR file, lsof tries to locate the associated device node by looking for matches on the major and minor device numbers first.

If no major and minor match results, lsof then looks for a match on pseudo and clone device files. (See /devices/pseudo.) Those device nodes are matched specially by either their

major or minor device numbers, but not both. Hence, when lsof finds a match under those special conditions, it may report a value in its output DEVICE column that differs from one of the major and minor numbers of the device node.

Here's an example from a sun4m Solaris 7 system:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root  sys  117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
COMMAND ... DEVICE ...  NODE NAME
powerd    117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun     ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
```

Note that the DEVICE value for the file with (COMMON) in its name field has a different minor device number (1) from what ls reports (0), while the DEVICE value for the file without (COMMON) matches the ls output exactly. Both match on the major device number, 117. The minor device number mis-match is a result of the way the Solaris kernel handles special file system common vnodes, and it's the reason lsof puts (COMMON) after the name to signal that a mis-match is possible.

17.14 Why don't lsof and Solaris pfiles reports always match?

/usr/proc/bin/pfiles for Solaris 2.6, 7, 8, and 9 also reports information on open files for processes. Sometimes the information it reports differs from what lsof reports.

There are several reasons why this might be true. First, because pfiles is a Sun product, based on Sun kernel features, its developers have a better chance of knowing exactly how open file information is organized. I sometimes have to guess at how kernel file structure linkages are constructed by gleaning hints from header files.

Second, lsof is aimed at providing information, specifically device and node numbers, that can be used to identify named file system objects -- i.e., path names. Thus, lsof tries to make sure its device and node numbers match those reported by stat(2). Pfiles doesn't always report numbers that match stat(2) -- e.g., for files using clone and pseudo devices via common vnodes like the nlist() /dev/ksyms usage.

Here's the Solaris 7 COMMON VCHR example again with additional pfiles output:

```

$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root  sys  117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
vic1: 10 = lsof /dev/pm
COMMAND ... DEVICE ...  NODE NAME
powerd ... 117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
$ pfiles ...
0: S_IFCHR ... dev:32,24 ino:61945 ... rdev:117,1
...
14: S_IFCHR ... dev:32,24 ino:151261 ... rdev:117,0

```

Note that the NODE number, reported by lsof, matches what ls(1) and stat(2) report, while the ino value pfiles reports doesn't. Lsof also indicates with the (COMMON) notation that the DEVICE number is a pseudo one, derived from the character device's value. The lsof DEVICE value matches the pfiles rdev value, correct behavior for a character device, but pfiles gives no sign that it's not possible to find that character device number in /devices with ls(1) or stat(2).

17.15 Why does lsof say, "kvm_open(namelist=default, core=default): Permission denied?"

Lsof needs permission to read from the /dev/kmem and /dev/mem memory devices. Access to them is opened via a call to the kvm_open() library function and it reports the indicated message.

You must give lsof permission to read the memory devices. The super user can almost always do that, but other lsof users can do it if some group -- e.g., sys -- has permission to read the memory devices, and the lsof binary is installed with the group's ownership and with the setgid permission bit enabled.

17.16 Why is lsof slow on my busy Solaris UFS file system?

Lsof may be slow on a busy Solaris UFS file system when UFS logging has been enabled with the "logging" mount option. That option can significantly increase disk operations under certain conditions -- e.g., when a lot of files are accessed quickly.

When only the "logging" option is specified to mount, all file accesses (atime updates) are logged to the UFS logging queue. Each atime update requires two writes to the disk

to complete it.

If you want to do UFS logging -- and there are reliability advantages to it -- consider using the "logging,noatime" mount options instead. That will shift atime updates from the logging queue to fewer and independent asynchronous operations, consequently making the UFS logging queue a smaller bottleneck.

Consult mount_ufs(1M) for more information on the logging and noatime options.

(My thanks to Casper Dik for this tip on improving the performance of UFS logging.)

17.17 Why is lsof so slow on my Solaris 8 or 9 system?

Solaris 8 has a post-release feature upgrade modifying kernel name cache (DNLC) handling that can slow lsof throughput dramatically. The feature, sometimes called negative DNLC caching, is standard in Solaris 9.

As best I can tell, when you install the Solaris 8 MU1 package, you get negative DNLC caching. If this pipe produces any output, your system has negative DNLC caching.

```
$ nm /dev/ksyms | grep negative_cache_vnode
```

The reason negative DNLC caching perturbs lsof is that a single vnode address (found in the negative_cache_vnode kernel variable) is used to mark entries in the DNLC that are not (the negative part) found on disk.

Since a single vnode address (the DNLC key lsof uses) can represent many (I've seen upwards of 30,000.) DNLC entries, their presence overloads lsof's internal DNLC hashing function. An overloaded hash function is a slow hash function, and lsof's slows to a crawl when it encounters thousands of keys that produce the same value when the lsof DNLC hash function is applied to them.

The solution is simple -- ignore negative DNLC cache keys. They don't represent path name components lsof can use. Lsof revisions 4.50 and above have an addition that ignores them and the performance of those lsof revisions improves significantly when presented with negative DNLC cache keys.

If you don't have an lsof revision at 4.51 or later, there's

a work-around. Use lsof's ``-C" option. It disables lsof's DNLC caching. Of course, that also inhibits the reporting of any path name components from the kernel DNLC. When ``-c" is used, lsof will continue to report file system and character device paths.

17.18 Solaris and VxFS

17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?

Lsof will not support VxFS version 3.4 on Solaris 2.6 and above unless some files from VxFS Update 2 have been installed. VxFS 3.4 FCS and VxFS 3.4 update 1 lack the header files lsof normally uses to obtain information from the VxFS 3.4 kernel node structure, vx_inode. VxFS 3.4 Update 2 provides a method whereby lsof can obtain the necessary vx_inode information from the vxfsu_get_ioffsets() function in Veritas utility libraries.

The utility libraries (32 bit and 64 bit versions) may be found in /opt/VRTSvxfs/lib. An ancillary header file may be found in /opt/VRTSvxfs/include/sys/fs/vx_libutil.h. Documentation of the vxfsu_get_ioffsets(3) function may be found in /opt/VRTS/man/man3/vxfsu_get_ioffsets.3.

Those files of VxFS 3.4 Update 2 may be downloaded from:

```
ftp://ftp.veritas.com/pub/support/vxfs_34.i64243.tar
```

The vxfs_34.i64243.tar archive will unpack into an i64243 directory containing these files:

```
$ ls i64243
README
libvxfsutil.sol26.sums
libvxfsutil.sol26.tar.Z
libvxfsutil.sol27.sums
libvxfsutil.sol27.tar.Z
libvxfsutil.sol28.sums
libvxfsutil.sol28.tar.Z
```

Read README. Select the *.tar.Z file appropriate for your Solaris version. Its contents will unpack into /opt/VRTS and /opt/VRTSvxfs, so you will need sufficient permission -- e.g., do it as root -- to unpack the uncompressed archive. Once you've done that, it's a good idea to compare the checksums of the archive you unpacked with the ones recorded in the appropriate *.sums file. Use `sum -r` to verify

the checksums.

For example, if you want the Solaris 8 version, uncompress and unpack libvxfstutil.sol28.tar.Z -- e.g.,

```
$ su
...
# cd i6423
# zcat libvxfstutil.sol28.tar.Z | tar xf -
```

That should create these new files and subdirectories with the indicated checksums:

```
File or subdirectory  sum -r

/opt/VRTSvxfs/include/vxfstutil.h 03938
/opt/VRTSvxfs/lib/libvxfstutil.a 51794
/opt/VRTSvxfs/lib/sparcv9/
/opt/VRTSvxfs/lib/sparcv9/libvxfstutil.a 07420
/opt/VRTS/man/man3/
/opt/VRTS/man/man3/vxfstu_get_ioffsets.3 62480
```

Once these files are in place, run lsof's Configure script for the solaris or solariscc abbreviation. Configure will locate the appropriate VxFS 3.4 Update 2 files and set up for the making of an lsof that will properly display open VxFS 3.4 file information.

17.18.2 Why does lsof report "vx_inode: vxfstu_get_ioffsets error" for open Solaris 2.6 and above VxFS 3.4 and above files?

Even when lsof supports VxFS 3.4 and above on Solaris 2.6 and above, it may report "vx_inode: vxfstu_get_ioffsets error" in the NAME column for all VxFS files.

The usual cause is that lsof doesn't have permission to read the file at the end of the /dev/vxportal symbolic link. If, for example, lsof has been installed setgid(sys), then the /dev/vxportal symbolic link destination should be owned by the sys group and readable by it.

Update 2 for VxFS 3.4 sets the modes of the /dev/vxportal symbolic link destination to 0640 and the group ownership to sys. But I have had a report that the modes are wrong in a VxFS 4.0 installation.

Another cause may be that the system has more than one version of VxFS installed (Only one can be active.), and lsof's

Configure script did not choose the header files and libraries for the active VxFS version. Configure opts for VxFS 4.0 and above header files and libraries (in /opt/VRTS) in preference to those for VxFS below 4.0 (in /opt/VRTSvxfs).

Look for the directories /opt/VRTS and /opt/VRTSvxfs. If you have /opt/VRTS, make sure its header and library symbolic links point to those of the active VxFS version.

If you have both directories, look at the CFLAGS that Configure constructed for making lsof and see which directory path follows a -I option. If that doesn't match the directory path of the active VxFS version, try pointing Configure at the correct directory with the SOLARIS_VXFSINCL environment variable -- e.g.,

```
$ SOLARIS_VXFSINCL=/opt/.../include ./Configure -n solaris
```

17.18.3 Why does Solaris Configure claim there is no VxFS library?

The lsof Configure script, when configuring for Solaris, may report:

```
FATAL: no VxFS .../libvxfsutil.a
```

That fatal error message indicates lsof has found the VxFS utility library's header files, but can't find the library itself in the expected location adjacent to the header files.

One possible cause is an incorrect symbolic link from /opt/VRTS/lib/sparcv9/libvxfsutil.a to the library's real location. (Some VxFS distributions declared the link incorrectly.) Use `ls -lL` on that path to see if it exists. If it doesn't exist, the link may be missing an additional leading "../" component.

If the problem is a missing "../" from the library's link, you can correct the link or check with Veritas/Symantec for the patch that corrects it.

If the problem is not a missing "../", and you know the libvxfsutil.a location, you can define its path in the SOLARIS_VXFSLIB environment variable before running the lsof Configure script. (See 00XCONFIG for information about using the SOLARIS_VXFSLIB environment variable.)

If you have no libvxfsutil.a, you must obtain it from Veritas/Symantec or find it in your VxFS installation package.

17.18.4 Why doesn't Solaris lsof report VxFS path name components?

Solaris lsof will report path name components for VxFS versions that use the common Solaris Dynamic Name Lookup Cache (DNLC) or on some file systems of VxFS versions that support the VxFS Reverse Name Lookup (RNL) facility.

VxFS versions 3.3 (approximately) and below use the common Solaris DNLC. (I haven't been able to determine exactly when VxFS stopped using the DNLC.) For versions above that boundary, but below 4.0, lsof can't report path name components.

At VxFS 4.0 and above, lsof can be compiled to use the VxFS RNL facility for reporting path names. If "-DHASVXFSRNL" appears in the compiler flags section of lsof "-v" option output, then the lsof Configure script detected the VxFS RNL facility and lsof has been compiled to use it.

lsof's use of the RNL facility can fail when the VxFS file system disk layout version is below 6. In that case, lsof can report no path name components. For more information, see the vxfs_inotopath(3) manual page. any of the following commands will show the disk layout version for a VxFS file system, when supplied the block device or mount point on which the file system is mounted.

```
fstyp -v <block_device>  
or  
mkfs -m <block_device>  
or  
vxupgrade <mount_point>
```

You must have permission to read the block device -- e.g., be the root user.

You may also be able to upgrade an older disk layout to one that will work with the RNL. See the vxupgrade(1M) man page for more information on that.

When lsof can't report VxFS path name components, it reports the file system mount point and the path name of device on which it is mounted. The device path name is enclosed in parentheses.

17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?

Solaris 10 lsof may report a bogus, scrambled path for an open

VxFS file, when lsof obtains the path from a vnode's cached path. Veritas/Symantec reports that their Solaris 10 implementation has bugs in the way it handles the Solaris 10 vnode cached path and those bugs will be fixed in an upcoming patch some time after August 15, 2005.

When Solaris 10 lsof reports a path for an open VxFS file obtained via the VxFS Reverse Name Lookup facility, the path will be correct.

Also see the answers to the questions "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why doesn't Solaris lsof report VxFS path name components?"

17.19 Large file problems

17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?

When given an argument that is the path to a Solaris 2.5.1 file, enable for large file operations with the `O_LARGEFILE` `open(2)` option, lsof complains that it can't stat(2) the file. That's because lsof isn't using a stat(2) call and associated structure enabled for large files.

This error has been fixed, starting at lsof revision 4.58 for Solaris 2.6 and above. That fix won't work on Solaris 2.5.1 and I no longer have access to a Solaris 2.5.1 test system to develop a separate fix.

The work-around is to avoid specifying a `O_LARGEFILE` path as an argument to lsof on Solaris 2.5.1. Instead use a combination of lsof and grep to achieve the same results, albeit more clumsily.

17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?

I have received a report from Gary Craig that lsof produces a segmentation fault on his 64 bit Solaris 8 system using NIS+. Via an independent test program we have exonerated lsof and tracked the fault to the NIS+ `__nis_server_name()` function in the C name server library, `-lnsl`.

Lsof causes the `__nis_server_name()` NIS+ function to be called by calling `getservent()` to read entries of the port number to service name map.

The only Sun bug ID that appears to describe the problem is 4304244, although its text is unclear enough to leave room for doubt.

Until Sun eliminates the `__nis_server_name()` segmentation fault cause, a work-around for `lsof` is to use its "-P" option, causing `lsof` to avoid port to service name lookups.

17.21 Will `lsof` crash the Solaris kernel?

I've received and investigated one report that it has when the Sun hardware (a QME interface) was faulty. Today (May 23, 2002) I've learned that Sun has reports of kernel crashes caused by `adb`, `lsof`, and `mdb`.

The Sun investigation pinpointed a problem in the `/dev/kmem` kernel driver and there is a Sun bug report, 4344513, about the problem. There is a fix in Solaris 9, and patches for Solaris 7 and 8 (SPARC and x86).

To see if your Solaris system is fixed, look for a `/devices/pseudo/*allkmem` node.

Extensive address filtering was added to `lsof` revision 4.50 to forestall what I then (July 2001) believed to be only the possibility that `lsof` might crash Solaris. However, the filtering isn't perfect, since a filtered address might become invalid after `lsof` has filtered it but before `lsof` has delivered it to `/dev/kmem`. That filtering work is described in `.../dialects/sun/solaris_kaddr_filters`, also available at:

ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris_kaddr_filters

The best and safest work-around is to upgrade to Solaris 9 or install an appropriate patch or its equivalent from this list:

Solaris	SPARC	x86
Version	Patch	Patch
=====	=====	=====
7	106541-20	106542-20
8	108528-14	108529-14

17.22 Why does `lsof` on Solaris 7, 8, or 9 report a `kvm_open()` failure?

When `lsof` is started on some Solaris 7, 8, and 9 systems

it may report:

```
lsof: kvm_open(namelist=default, corefile=default): \  
No such file or directory
```

Lsof revisions 4.65 and later will first report:

```
lsof: cannot stat /dev/allkmem
```

The second message, not delivered in lsof revisions below 4.65, explains the cause of the `kvm_open()` failure; it can't find `/dev/allkmem`.

`/dev/allkmem` is a device added to Solaris 7 and 8 in patches and in the Solaris 9 FCS. See the preceding "Will lsof crash the Solaris kernel?" section for more information on `/dev/allkmem` and the patches.

The `kvm_open(3KVM)` function in the KVM library of patched Solaris 7 and 8 systems and in Solaris 9 expects to find `/dev/allkmem` and exits on error when it does not.

If you have installed the patch that updated your KVM library to a version that expects `/dev/allkmem` to be present and it is not, you may need to reconfigure your system's devices with `devfsadm(1M)` or enter "boot -r" to the OpenBoot monitor's prompt (usually "ok").

17.23 Solaris and SAM-FS

17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?

Lsof 4.68 and above report "(limited SAM-FS info)" on Solaris in the NAME column after the path or file system name for all files it finds on SAM-FS file systems.

That's because no more information is known about the composition of the nodes that follow SAM-FS vnodes. If you can provide that information, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

17.23.2 Why can't lsof locate named SAM-GS files?

Solaris lsof 4.68 and above can't locate files on SAM-FS file systems when the files are named as lsof arguments because lsof doesn't know how to locate open SAM-FS file

device and node number information. (See also 'Why does Solaris lsof report "(limited SAM-FS info)?')

17.24 Lsof and Solaris 10 zones

17.24.1 How can I make lsof list the Solaris zone?

Use the lsof "-z [z]" option.

17.24.2 Why doesn't lsof work in a Solaris 10 zone?

When run from within a Solaris 10 zone, lsof will usually report:

```
lsof: can't stat(/devices): No such file or directory
```

That's because a Solaris zone usually has no /devices subdirectory, a restriction of the zone implementation intended to limit the ability of zone processes to control global system resources, including physical devices.

While a zone may have a /dev subdirectory, that subdirectory usually lacks the /dev/allkmem, /dev/mem and /dev/kmem devices lsof and the KVM library it uses require.

The work-around is to run lsof in the global zone. When it is run in a global zone lsof will be able to report on processes running in any zone, including the global zone.

17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?

When run from the global zone on Solaris 10 lsof may complain:

```
lsof: WARNING: can't stat() 15 zone file systems;  
using dev= options
```

The warning message means lsof found the reported number of file system entries in the mount table for which it didn't have permission to get stat(2) results, but which had "zone=" and "dev=" mount table options.

That is a normal restriction of Solaris 10 zones. Since the lsof warning message indicates it was able to find "dev=" options for the file systems, lsof will probably work correctly.

One work-around is to relax the restrictions on zone mount

points, so that lsof can stat() them. While that may be possible by changing directory modes or group ownerships, it is probably not a good idea, because it weakens the restrictions zones are intended to provide.

Another work-around is to suppress the warning message with lsof's "-w" option. The down side of that is that it causes the suppression of all warning messages, leading to the possibility that some non-stat() warning messages will be suppressed.

17.25 Solaris 10 problems

17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?

When a path name component is renamed -- e.g., with mv(1) -- Solaris 10 lsof may report the old component for an open file that used the component in its path before the rename. That's because Solaris 10 lsof reports the path name cached in the open file's vnode and the Solaris 10 kernel doesn't update the open vnode's cached path name when a component of it is changed.

When an open file is deleted -- e.g., with rm(1) -- the path name by which it was opened remains cached in the vnode. Lsof can be instructed to display that path name with the -X option. The path name might be incorrect because of the rename problem described above. See the answer to the 'What does "(deleted)" mean in the NAME column of a Solaris 10 open file?' question for more information.

Lsof is sometimes able to detect that cached path name is incorrect. In that case lsof may report only the mounted-on directory and device of the file system or it may report that the path name is of questionable accuracy by appending a trailing "(?)" to it in the NAME column.

See the answer to the "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" and 'What does "(?)" mean in the NAME column of a Solaris 10 open file?' questions for more information.

17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?

For some regular open files lsof may report only the mounted-on directory and device of the file system on which the file resides. That's because lsof was able to determine that the path name cached in the open file's vnode is incorrect.

Lsof detects the cached path name is incorrect by applying `stat(2)` to it, provided that no error was detected when `stat(2)` was applied to the file system mounted-on directory during lsof setup. If a mounted-on directory `stat(2)` error was detected during setup, lsof does no cached path name analysis and simply reports it.

When the application of `stat(2)` to the cached path name returns a no-entry reply (the `ENOENT` error number), lsof concludes the path no longer exists (i.e., has been unlinked) and reports the mounted-on directory and device of the file system. That behavior can be modified with the `-X` option in lsof revisions 4.77 and above. See the answer to the 'What does "(deleted)" mean in the NAME column of a Solaris 10 open file?' for more information.

When the application of `stat(2)` to the cached path name returns a permission error reply (the `EACCES` or `EPERM` error numbers), lsof reports the cached path name and adds a trailing "?" to indicate the reported path name is of questionable accuracy. See the answer to the question 'What does "?" mean in the NAME column of a Solaris 10 open file?' for more information.

If the application of `stat(2)` to the cached path name yields any other error reply, lsof reports the mounted-on directory and device of the file system.

When the application of `stat(2)` to the cached path name succeeds, lsof compares the reported device and node numbers to what it has obtained for the open file from kernel structures. If they match, lsof reports the cached path name. If they don't match, lsof instead reports the mounted-on directory and device of the file system.

A work-around that allows lsof to apply `stat(2)` successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?

When the `-X` option is specified to Solaris 10 lsof, it will report in its NAME column the path name cached for a deleted file in its vnode. The path name will be followed by "(deleted)".

Note that the path name cached in a file's vnode is the path

name by which the file was opened. It is not updated by the Solaris kernel when any path name component is changed. Hence, it may not represent the final path name the open file had.

See the answer to the "Why does Solaris 10 lsof sometimes report the wrong path name?" question for more information on how changing a path name component affects the correctness of a what lsof reports.

17.25.4 What does "(?)" mean in the NAME column of a Solaris 10 open file?

When lsof encounters a path name cached in the open file's vnode that stat(2) reports lsof lacks permission to access, lsof adds "(?)" to the path name reported in the NAME column to indicate the path name is of questionable accuracy.

See the answers to the "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" questions for more information on why lsof may report a path name of questionable accuracy.

A work-around that allows lsof to apply stat(2) successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.26 Solaris contract file problems

17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?

Lsof doesn't report size, link count or node number for Solaris 10 contract files because I don't know how to obtain them from contract file kernel structures.

17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?

Because lsof can't find the node number of Solaris contract files, it can't match the device and node numbers it gets from applying stat(2) to the contract file path name with what it finds in kernel data.

17.27 Solaris 10 ZFS problems

17.27.1 Why does Configure ask for the location of ZFS header files?

To provide ZFS support when lsof is compiled it needs to have

access to the definitions of ZFS structures used by the kernel. Those definitions are contained in header files that Sun does not distribute with Solaris 10.

When the Configure script detects the system might support ZFS by finding the <sys/fs/zfs.h> header file, it checks for the required ZFS kernel structure definition header files. When they are not found, it asks if ZFS support should be included and if so, with what definitions.

Two sources can be declared for definitions: 1) lsof's internal ones; or 2) the necessary header files at some location other than /usr/include/sys.

The necessary header files are:

```
dmu.h zfs_acl.h zfs_debug.h zfs_rlock.h zil.h  
spa.h zfs_context.h zfs_dir.h zfs_vfsops.h zio.h  
txg.h zfs_ctldir.h zfs_ioctl.h zfs_znode.h zio_impl.h
```

The necessary header files might have been obtained, for example, from the <http://src.opensolaris.org> Open Solaris source site. However, the Open Solaris header files might not be adequate -- see the answer to the "Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?" question for information on why the Open Solaris ZFS header files might not provide correct ZFS kernel structure definitions.

The supplied header file path must point to a directory that contains a sys/ subdirectory where the matching header files are located -- e.g., if the supplied path is /tmp/zfs, then /tmp/zfs/sys must contain the necessary header files.

See the answer to the "Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?" question for information on the risks associated with using lsof's internal definitions.

17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?

When lsof is configured to use its internal ZFS kernel structure definitions, there is the chance that the definitions may be out of date. Hence, an lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

Please contact me via e-mail at <abe@purdue.edu> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?

The Open Solaris ZFS header files may not provide correct ZFS kernel definitions. An lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

The definitions may be incorrect because the Open Solaris header files are not synchronized with any particular Solaris 10 release. Consequently they might contain modifications to the structures not in the structure definitions used to build the running kernel. It may be that only Sun has header files that match the kernel structures of the running Solaris 10 kernel.

Please contact me via e-mail at <abe@purdue.edu> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

17.28 Problems with Solaris 9 and above

17.28.1 Why does the compiler complain about lgrp_root on Solaris 9 and above?

When compiling lsof 4.84 on later Solaris 9 and 10 systems, the compiler may report the following error:

```
/usr/include/sys/lgrp.h", line ...: identifier redeclared: lgrp_root
```

This error results from a conflict between usage of lgrp_root in both <sys/lgrp.h> and <sys/lgrp_user.h> when _KMEMUSER or _KERNEL is #define'd before <sys/lgrp.h> is #include'd. This problem is noted in Sunsolve bug ID 5064229.

The work-around is to use lsof revision 4.85 sources.

18.0 Lsof Features

18.1 Why doesn't lsof report on /proc entries on my system?

/proc file system support is generally available only for BSD, SYSV R4 dialects, and Tru64 UNIX (Digital UNIX, DEC OSF/1). It's also available for Linux, and Pyramid DC/OSx and Reliant UNIX.

Even on some SYSV R4 dialects I encountered many problems while trying to incorporate /proc file system support. The chief problem is that some vendors don't distribute the header file that describes the /proc file system node -- usually called prdata.h.

18.2 How do I disable the device cache file feature or alter it's behavior?

To disable the device cache file feature for a dialect, remove the HASDCACHE definition from the machine.h file of the dialect's machine.h header file. You can also use HASDCACHE to change the default prefix (`.lsof`) of the device cache file.

Be sure you consider disabling the device cache file feature carefully. Having a device cache file significantly reduces lsof startup overhead by eliminating a full scan of /dev (or /devices) once the device cache file has been created. That full scan also overloads the kernel's name cache with the names of the /dev (or /devices) nodes, reducing the opportunity for lsof to find path name components of open files.

If you're worried about the presence of mode 0600 device cache files in the home directories of the real user IDs that execute lsof, consider these checks that lsof makes on the file before using it:

1. To read the device cache file, lsof must gain permission from access(2).
2. The device cache file's modes must be 0600 (0644 if lsof is reading a system-wide device cache file) and its size non-zero.
3. There must be a correctly formatted section count line at the beginning of the file.
4. Each section must have a header line with a count that properly numbers the lines in the section. Legal sections are device, clone, pseudo-device, and CRC.

5. The lines of a section must have the proper format.
6. All lines are included in a 16 bit CRC, and it is recorded in a non-checksummed section line at the end of the file.
7. The checksum computed when the file is read must match the checksum recorded when the file was written.
8. The checksum section line must be followed by end-of-information.
9. Lsof must be able to get matching results from stat(2) on a randomly chosen entry of the device section.

For more information on the device cache file, read the 00DCACHE file of the lsof distribution.

18.2.1 What's the risk with a perverted device cache file?

Even with the checks that lsof makes on the device cache file, it's conceivable that an intruder could modify it so it would pass lsof's tests.

The only serious consequence I know of this change is the removal of a file whose major device number identifies a socket from some user ID's device cache file. When such a device has been removed from the device cache file, and when lsof doesn't detect the removal, lsof may not be able to identify socket files when executed by the affected user ID. Only certain dialects are at risk to this attack -- e.g., SCO OpenServer and Solaris 2.x, 7, 8, and 9.

If you're tracking a network intruder with lsof, that could be important to you. If you suspect that someone has corrupted the device cache file you're using, I recommend you use lsof's -Di option to tell it to ignore it and use the contents of /dev (or /devices) instead; or remove the device cache file (usually .lsof_hostname, where hostname is the first component of the host's name returned by gethostname(2)) from the user ID's home directory and let lsof create a new one for you.

18.2.2 How do I put the full host name in a personal device cache file path?

Lsof constructs the personal device cache file path name from a format specified in the HASPERSDC #define in the dialect's machine.h header file. As distributed HASPERSDC declares the path to be ``.lsof_ " plus the first component of the host name with the format ``.lsof_%L".

If you want to change the way lsof constructs the personal device cache file path name, you can change the HASPERSDC #define and recompile lsof. If, for example, you #define HASPERSDC to be ``.lsof_%l" (note the lower case `l'), Configure and remake lsof, then the personal device cache file path will be ``.lsof_ " plus the host name returned by gethostname(2).

See the 00DCACHE file of the lsof distribution for more information on the formation of the personal device cache file path and the use of the HASPERSDC #define.

18.2.3 How do I put the personal device cache file in /tmp?

Change the HASPERSDC definition in your dialect's machine.h header file.

When you redefine HASPERSDC, make sure you put at least one user identification conversion in it to keep separate the device cache files for each user of lsof. Also give some thought to including the ``%0" conversion to define an alternate path for setuid-root and root processes.

Here's a definition that puts a personal device cache file in /tmp with the name ``.lsof_login_hostname_pers".

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers"
```

Thus the /tmp personal device cache file path for login "abe" on host "lsof.itap.purdue.edu" would be:

```
/tmp/.lsof_abe_lsof.itap.purdue.edu_pers
```

You can add the User ID (UID) with the "%U" conversion and the first host name component with the ``%L" conversion.

CAUTION: be careful using absolute paths like /tmp lest lsof processes that are setuid-root or whose real UID is root be used to exploit some security weakness via /tmp. Elect instead to add an alternate path for those processes with the ``%0" conversion. Here's an extension of the

previous HASPERSDC format for /tmp that declares an alternate path:

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers%0%h/.lsof_%L"
```

When the lsof process is setuid-root or its real UID is root, presuming root's home directory is '/' and the host's name is ``lsof.itap.purdue.edu'', the extended format yields:

```
/.lsof_vic
```

18.3 Why doesn't lsof know about AFS files on my favorite dialect?

Lsof currently supports AFS for these dialects:

```
AIX 4.1.4 (AFS 3.4a)
Linux 1.2.13 (AFS 3.3)
NEXTSTEP 3.2 (AFS 3.3)
Solaris 2.[56] (AFS 3.4a)
```

It may recognize AFS files on other versions of these dialects, but I have no way to test that. Lsof may report correct information for AFS files on other dialects, but I can't test that either.

AFS support must be custom crafted for each UNIX dialect and then tested. If lsof supports your favorite dialect, but doesn't recognize its AFS files, probably I don't have access to a test system. If you want AFS support badly for your dialect, consider helping me do the development and testing.

18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

When AFS is implemented via dynamic kernel modules -- e.g., in NEXTSTEP -- lsof can't obtain the addresses of AFS variables in the kernel that it uses to identify AFS vnodes. It can guess that a vnode is assigned to an AFS file and it can obtain other information about AFS files, but it has trouble computing AFS volume node numbers.

To determine node numbers for AFS volumes other than the root volume, /afs, lsof needs access to a hashed volume structure pointer table. When it can't find the address of that table, because AFS support is implemented via dynamic kernel modules, lsof will return blanks in the INODE column for AFS volume files. Lsof can identify the

root volume's node number (0), and can compute the node numbers for all other AFS files.

If you have a name list file that contains the addresses of the AFS dynamic modules -- e.g., you saved module symbols when you created a loadable module kernel with `modload(8)` by specifying `-sym` -- `lsof` may be able to find the kernel addresses it needs in that file.

`lsof` looks up AFS dynamic kernel addresses for these dialects at these default paths:

```
NEXTSTEP 3.2 /usr/vice/etc/afs_loadable
```

A different path to a name list file with AFS dynamic kernel addresses may be specified with the `-A` option, when the `-A` option description appears in `lsof's -h` or `-? (help)` output.

If any addresses appear in the `-A` name list file that also appear in the regular kernel name list file -- e.g., `/vmunix` -- they must match, or `lsof` will silently ignore the `-A` addresses on the presumption that they are out of date.

Found in path(s):

```
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/00FAQ
```

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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/freebsd/dnode1.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dproc.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/n+obsd/dnode1.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dsock.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/darwin/kmem/dnode1.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/machine.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dlsof.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dproto.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dstore.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dnode.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/hpux/kmem/dnode1.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dmnt.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/osr/dfile.c

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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dlsof.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dproto.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/lib/ptti.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/lib/dvch.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dnode.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/lib/rnch.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dstore.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dfile.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dsock.c
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/sun/dnode2.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/lib/rnam.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/lib/lkud.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dproc.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isof-4-85-zip/dialects/linux/dmnt.c

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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/scripts/list_fields.perl
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/scripts/idrlogin.perl
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/scripts/list_fields.awk
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dstore.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dproto.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/machine.h

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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dmnt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/ddev.c
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/tests/LTnlink.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/tests/LTbigf.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/tests/LTsoff.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/tests/LTsock.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/tests/LTunix.c
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* \$Id: pfsnode.h,v 1.1 1993/12/12 12:26:39 davidg Exp \$
*/

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Found in path(s):

- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/dsock.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/dfile.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/dproc.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/dstore.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/dproto.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/machine.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/hpux/pstat/dlsof.h

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 */
/* Definitions for data structures and routines for the regular
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```

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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dlsof.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dnode2.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dproc.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dstore.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dfile.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dproto.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/machine.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+os/dnode1.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/uw/dnode1.c

* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/sun/dnode1.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/uw/dmmt.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/uw/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/uw/dsock.c
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* @(#)cdefs.h 8.2 (Berkeley) 10/4/93

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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/kmem/dstore.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+obsd/dproto.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/dmnt.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dfile.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dmnt.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dstore.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/dlsof.h
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dproc.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dproto.h
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dlsof.h
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dsock.c
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/proc.c
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/machine.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dmnt.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/dsock.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/Isf_fields.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/ddev.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/dstore.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/arg.c
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- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+os/machine.h

* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/dproc.c
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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+os/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/aix/machine.h
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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dstore.c
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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dlsof.h
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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/machine.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+os/dproc.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dnode.c
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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/du/dfile.c
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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/kmem/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/freebsd/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dsock.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/sun/dnode.c
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/Isf.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/hpux/kmem/dproto.h
* /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/n+obsd/dsock.c
No license file was found, but licenses were detected in source scan.

/*

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*

* Written by Victor A. Abell

*

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*
- * 3. Altered versions must be plainly marked as such, and must not be
* misrepresented as being the original software.
*
- * 4. This notice may not be removed or altered.

*/
/*

* GetOpt() -- Local get option

- *
* Liberally adapted from the public domain AT&T getopt() source,
* distributed at the 1985 UNIFORM conference in Dallas
*
- * The modifications allow '?' to be an option character and allow
* the caller to decide that an option that may be followed by a
* value doesn't have one -- e.g., has a default instead.
*/

Found in path(s):

* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/main.c

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

/*

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- *
- * 4. This notice may not be removed or altered.
- */

Found in path(s):

- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/freebsd/dzfs.h
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/util.c
- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/freebsd/dnode2.c

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

/*

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- *

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*

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- *

- * 3. Altered versions must be plainly marked as such, and must not be misrepresented as being the original software.
- *

- * 4. This notice may not be removed or altered.
- */

Found in path(s):

- * /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/dialects/darwin/kmem/dfile.c

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

Notes for the distribution of lsof version 4

| The latest release of lsof is always available via anonymous ftp |
 | from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof. |

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4.82, March 25, 2009
4.83, January 18, 2010
4.84, July 29, 2010
4.85, September 27, 2011

Dialects Supported

=====

Lsof (for LiSt Open Files) lists files opened by processes on selected Unix systems. Version 4 is a source reorganization of version 3, itself a major revision of version 2. Version 4 has been tested on:

AIX 5.3
Apple Darwin 9 and Mac OS X 10.[56]
FreeBSD 4.9 and 6.4 for x86-based systems
FreeBSD 8.[02] and 9.0 for AMD64-based systems
Linux 2.1.72 and above for x86-based systems
Solaris 9, 10 and 11

(The pub/tools/unix/lsof/contrib directory on lsof.itap.purdue.edu contains information on other ports.)

If your favorite Unix dialect is not in the list, or if your version of it is more recent than the ones listed, please contact me at [<abe@purdue.edu>](mailto:abe@purdue.edu).

Version 3 of lsof was tested on:

AIX 3.2.5, 4.1.[1234], and 4.2
BSDI BSD/OS 2.0, 2.0.1, and 2.1 for x86-based systems
DC/OSx 1.1 for Pyramid systems
Digital UNIX (DEC OSF/1) 2.0, 3.0, 3.2, and 4.0
EP/IX 2.1.1 for the CDC 4680
FreeBSD 1.1.5.1, 2.0, 2.0.5, 2.1, 2.1.5 for x86-based systems
HP-UX 8.x, 9.x, 10.01, 10.10, and 10.20
IRIX 5.2, 5.3, 6.0, 6.0.1, and 6.[124]

Linux through 2.0.27 for x86-based systems
NetBSD 1.0, 1.1, and 1.2 for x86 and SPARC-based systems
NEXTSTEP 2.1 and 3.[0123]
OpenBSD 1.2 and 2.0 for x86-based systems
Reliant UNIX 5.43 for Pyramid systems
RISC/os 4.52 for MIPS R2000-based systems
SCO OpenServer Release 1.1, 3.0, and 5.0.x for x86-based systems
SCO UnixWare 2.1 and 2.1.1 for x86-based systems
Sequent PTX 2.1.[1569], 4.0.[23], 4.1.[024], 4.2[.1], and 4.3
Solaris 2.[12345], 2.5.1, and 2.6-Beta
SunOS 4.1.x
Ultrix 4.2, 4.3, 4.4, and 4.5

Version 3 and its predecessor, version 2, may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

How Lsof Works

=====

Using available kernel data access methods -- `getproc()`, `getuser()`, `kvm_*`, `nlist()`, `pstat()`, `read()`, `readx()`, `/proc` -- `lsof` reads process table entries, task table entries, user areas and file pointers to reach the underlying structures that describe files opened by processes.

`lsof` interprets most file node structures -- `advfsnodes`, `autonodes`, `cnodes`, `cdrnodes`, `devnodes`, `fifonodes`, `gnodes`, `hsnodes`, `inodes`, `mfsnodes`, `pcnodes`, `procnodes`, `rnodes`, `snodes`, `specnodes`, `s5inodes`, `tmpnodes`. It understands NFS connections. It recognizes FIFOs, multiplexed files, Unix and Internet sockets. It knows about streams. It understands `/proc` file systems for some dialects. On many dialects it recognizes execution text and library references. It knows about AFS on some Unix dialects.

Lsof Output

=====

The `lsof` output describes:

- * the identification number of the process (PID) that has opened the file;

- * the process group identification number (PGID) of the process (optional);
- * the process identification number of the parent process (PPID) (optional);
- * the command the process is executing;
- * the owner of the process;
- * for all files in use by the process, including the executing text file and the shared libraries it is using:
 - * the file descriptor number of the file, if applicable;
 - * the file's access mode;
 - * the file's lock status;
 - * the file's device numbers;
 - * the file's inode number;
 - * the file's size or offset;
 - * the name of the file system containing the file;
 - * any available components of the file's path name;
 - * the names of the file's stream components;
 - * the file's local and remote network addresses;
 - * the TLI network (typically UDP) state of the file;
 - * the TCP state, read queue length, and write queue length of the file;
 - * the file's TCP window read and write lengths (Solaris only);
 - * other file or dialect-specific values.

Getting Started Quickly

=====

If you want to get started using lsof quickly, or see some examples

of how lsof can be used, consult the 00QUICKSTART file of the lsof distribution.

The 00QUICKSTART file won't help you build or install lsof, but it will cut through the density of the lsof man page, giving you more readily an idea of what you can do with lsof.

For information on building and installing lsof, consult the 00README file of the lsof distribution.

Limiting, Filtering, and Selecting Lsof Output

=====

Lsof accepts options to limit, filter, and select its output.

These are the possible criteria:

- * Process ID (PID) number -- to list the open files for a given process;
- * Process Group ID (PGID) -- to list the open files for all the processes of a given process group;
- * User ID number or login name -- to list the open files for all the processes of a given user;
- * Internet address -- to list the open files using a given Internet address (host name), protocol, or port (number or name); or to list all open Internet files;
- * command name;
- * file descriptor name or number;
- * list all open NFS files;
- * list all open Unix domain socket files;
- * list all uses of a specific file;
- * list all open files on a file system.

Selection options are normally ORed -- i.e., an open file meeting any of the criteria is listed. The selection options may be ANDed so that an open file will be listed only if it meets all the criteria.

In the absence of any selection criteria, lsof lists files open to

all processes.

Parsing Lsof Output with Another Program

=====

The lsof -F option directs it to produce "field" output that can easily be parsed by another program. The lsof distribution contains sample awk, perl 4, and perl 5 scripts in its scripts subdirectory that show how to post-process field output.

Repeat Mode

=====

Lsof can be directed to produce output, delay for a specified time, then repeat the output, cycling until stopped by an interrupt or quit signal. This mode is useful for monitoring the status of some file operation -- e.g., an ftp transfer or a tape backup operation.

Repeat mode is more efficient when combined with lsof's selection options, since they limit lsof overhead.

It's possible to use lsof's field output options to supply repeat mode output to another process for its manipulation. The scripts subdirectory of the lsof distribution has sample Perl scripts showing how to consume lsof repeat mode output from a pipe.

Distribution Restrictions

=====

Lsof may be used and distributed freely, subject to these limitations:

1. Neither the author nor Purdue University is responsible for any consequences of the use of this software.
2. The origin of this software must not be misrepresented, either by explicit claim or by omission. Credit to the author and Purdue University must appear in documentation and sources.
3. Altered versions must be plainly marked as such, and must not be misrepresented as being the original software.
4. This notice may not be removed from or altered in the lsof source files.

Cautions

=====

Lsof is a tool that is closely tied to the Unix operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version.

DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER.

On some Unix dialects, notably SunOS and Solaris, lsof versions may be even more restricted by architecture type. An lsof binary, compiled for SunOS 4.1.3 on a sun4c machine, for example, won't work on a sun4m machine.

AN LSOF BINARY, COMPILED FOR ONE SOLARIS 1.X ARCHITECTURE, ISN'T GUARANTEED TO WORK ON A DIFFERENT SOLARIS 1.X ARCHITECTURE.

Distribution Contents

=====

The lsof distribution is checked for completeness when it is constructed and by the Inventory script when you run the Configure script. (See The Inventory Script section of the 00README file of this distribution.)

Lsof is organized in these parts:

- * The main lsof directory, containing common sources, configuration and setup scripts and three subdirectories: dialects/, lib/, and scripts/.

Lsof is compiled in the main lsof directory after configuration. The selected dialect sources are copied or linked from the specified subdirectory. (Symbolic linking is the standard method.)

Common lsof definitions may be found in lsof.h; common function prototypes, proto.h; and common storage, store.c.

- * The dialects/ subdirectory contains subdirectories with sources specific to UNIX dialect implementations -- e.g., the dialects/sun/ subdirectory contains sources for the SunOS (Solaris 1.x) and Solaris (2.x) implementations of lsof. The dialects subdirectories also contain Makefiles and scripts for assisting dialect source configuration.

Dialect configuration definitions may be found in dlsof.h; other dialect definitions, dlsof.h; dialect prototypes, dproto.h; and dialect storage, dstore.c.

- * The lib/ subdirectory contains sources for common lsof functions. Not all dialects use the functions -- some have their own versions of them. The lib/ functions are enabled and customized with #define's in the dialect machine.h header files.
- * The scripts/ subdirectory contains sample scripts for processing lsof field (-F) output. The scripts are written in AWK, Perl 4, and Perl 5.

The 00PORTING file of the lsof distribution has more information on lsof components, configuration, and construction.

Warranty

=====

Lsof is provided as-is without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

Bug Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND A BUG REPORT ABOUT LSOF TO THE UNIX DIALECT VENDOR.

At worst such a bug report will confuse the vendor; at best, the vendor will forward the bug report to me.

Please send all bug reports, requests, etc. to me via email at <abe@purdue.edu>.

The lsof-l Mailing List

=====

Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

Version 3 Release Notes

=====

See 00DIST in the last lsof 3 revision 3.88, for its complete set of release notes. Lsof revision 3.88 may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

3.0 May 24, 1994

This is the first official release of lsof 3.

...

3.88 February 17, 1997

```
+=====+
| This is the last version 3 revision. |
+=====+
```

Added documentation files -- 00.README.FIRST[_<version>] and 00RELEASE.SUMMARY_<version> -- to the distribution.

What's new in Version 4

=====

The main goal of version 4 was to eliminate the confusing common/fragment source file technique. Changing the version number also provided an opportunity to restart the numbering, which at 3.88 had risen to a large value.

The sources that appeared in the dialects/common subdirectory of version 3 in fragment files have been incorporated into the version 4 liblsof.a library as *.c files. This results in significant changes to many source files, scripts, and Makefiles of all dialect versions. It allows elimination of some source files -- ddev.c, dfile.c, dmnt.c -- for dialects now obtaining functions from liblsof.a that formerly came from making dialect source files by combining fragment files.

The version 4 liblsof.a sources are stored in the lib/ subdirectory of the main lsof directory. The liblsof.a functions are activated and conditioned in their source files by values #define'd in the dialect dlsof.h and machine.h header files.

Dialects that provide a private version of a library function refrain from #define'ing the symbol that would activate the library function code.

Version 4 Release Notes

=====

4.0 February 24, 1997

```
+-----+
| This is the first lsof 4 revision. |
+-----+
```

Reorganized sources: eliminated code fragment files and created a library in their place. Modified or deleted many dialect source and header files. Changed documentation accordingly.

Added a warning to sgi/Makefile and 00FAQ that advises against using the IRIX C compiler -n32 option when compiling lsof. Thanks go to Peter Ilieve <peter@memex.co.uk> for bringing this to my attention.

Dropped IRIX 5.2 in mid-stream, because my 5.2 test system was upgraded to 5.3.

4.01 March 3, 1997

Added TFS support for Pyramid dialects.

Added test to Configure and to the IRIX dnode.c for the different cnode struct that appears in <cachefs/cachefs_fs.h> on the 6.2 IMPACT distribution. Heddy Boubaker <boubaker@amfou.cenatls.cena.dgac.fr> alerted me to the cnode change and helped test this lsof adjustment.

Shut down the lsof child process before doing a -r sleep(). A comment from Dan Mercer <dam@mmm.com> prompted this.

4.02 March 21, 1997

Based on a report from Pasi Kaara <Pasi.Kaara@atk.tpo.fi>, disabled HP-UX CCIT support in lsof for HP-UX versions 10 and above. Pasi's report also led to changes in the HP-UX machine.h to support use of gcc to compile lsof for HP-UX 10.20 and warnings against using `cc -Aa` or `gcc -ansi` to compile lsof under HP-UX 10.x.

With help from Richard Allen <ra@hp.is> taught HP-UX 10.x lsof to name file systems better by using the virtual file system device number. Elias Halldor Agustsson <elias@rhi.hi.is> provided a test system.

Changed NEXTSTEP and UNIXWARE Makefiles to use safer quoting when generating version.h. The change was suggested by Bob Farmer <ucs_brf@unx1.shsu.edu>.

Added SHELL=/bin/sh string to all Makefiles.

Added support for Linux 2.1.28 on a test system, kindly provided by Jonathan Sargent <sergent@purdue.edu>. Configure tests the Linux 2.1.x's C library lseek() function for proper handling of kernel offsets. If lseek() appears suspect, Configure activates the use of a private lseek() function. Changed the private nlist() function to nlist_private() and taught it to use the query_module() syscall in place of the deprecated get_kernel_syms() one. Added rudimentary AX.25 support for Pierfrancesco Caci <ik5pvx@infogroup.it> who helped test it. Updated the old get_kernel_syms() code to recognize and skip module name entries.

Prompted by Marty Leisner <leisner@sdsp.mc.xerox.com>, eased the requirement that service name lookup for the -i option be accompanied by a protocol name. The name is not needed if both TCP and UDP names yield the same port number.

Added xusers.awk script from Dan Mercer <damercer@mmm.com> to the distribution scripts/ subdirectory.

Changed Configure script to use LSOF_VERS for all UNIX dialect version numbers and to pass LSOF_VERS to the dialect Mksrc functions. Also added the ability for a dialect stanza to declare a different

dialect Makefile source. Modified dialect Mksrc files -- e.g., linux and sun -- accordingly.

Added support for BSD/OS 3.0 with help from Jim Reid <jim@mpn.cp.philips.com>. Terry Kennedy <TERRY@spcvxa.spc.edu> kindly provided a test system. During the port corrected a bug that prevented proper handling of revoked files.

4.03 April 7, 1997

At the suggestion of Dan Mercer <damercer@mmm.com>, made HP-UX building of lsof aware of differences between the HP-UX bundled and unbundled C compilers.

Added the ability for the lsof builder to define the default warning message issuance state. By default the issuance of warning messages is disabled; defining WARNINGSTATE in machine.h disables it. The Customize script was updated to handle WARNINGSTATE. Dan Mercer suggested this.

Eliminated compiler complaint about improperly cast get_NL_value() argument in ncache_load() in lib/rnch.c.

Corrected zeromem() argument error in SCO dproc.c.
Sped up parent directory cache lookup slightly.

Updated for PTX 4.4, including additional VxFS (EFS) file system support.

4.04 April 17, 1997

At the suggestion of Bela Lubkin <belal@sco.COM> changed device cache handling to be more tolerant of a device cache file whose [cm]times are older than the ones on /dev or /devices. The change required adding information to Solaris device cache file clone lines, so the first time lsof 4.04 is run under Solaris it will complain about a bad cached clone device in a previous device cache file, then regenerate it.

Added boot file path detection for SCO OSR 5 and above, based on information supplied by Bela.

Fixed two bugs in DEC OSF/1 lsof -- an error in reporting locks and a missing continue statement in readdev() after a failure to open a directory.
Jan Ole Suhr <josuhr@informatik.tu-clausthal.de>

reported the second bug and supplied a fix.

Fixed XFS problems with IRIX 6.2 by abandoning the idea that SGI will distribute XFS header files and defining an lsof-private xfs_inode structure. John Paul Morrison <John.Paul.Morrison@MultiActive.com> helped develop and test the 5.3 definition. John R. Vanderpool <fish@daacdev1.gsfc.nasa.gov> helped develop and test the 6.2 definition.

Remove obsolete comments about common/*.frag files.

Updated Linux lsof for Linux version 2.1.35.

4.04 April 18, 1997

Supplement Regenerated the 4.04 distribution to correct a non-device-cache #define misplacement in the Solaris and SunOS dlsof.h. Alexandre Oliva <oliva@dcc.unicamp.br> reported the problem.

4.05 April 24, 1997

Corrected an error in 00DCACHE.

Made sure SCO /etc/ps/booted.systems is closed.

Based on an observation by Bela Lubkin <belal@sco.COM> that the lsof child had needless file descriptors open, closed all but the open pipes between the lsof parent and child.

Decommissioned CDC EP/IX support; I no longer have a test system.

Based on a suggestion from Patrick Connor <connor@phreak.csd.sgi.com>, added -xansi to CFLAGS for IRIX 5.3 and 6.[234].

Also at Patrick's suggestion changed Configure to propagate exact SunOS 4.1.x version to the main and library Makefiles. This allowed the sunos413 and sunos413cc Configure abbreviations to be shortened to sunos and sunoscc.

Updated obsolete argument uses (-H changed to -n) in count_pf.perl* and watch_a_file.perl scripts.

Adjusted Solaris 2.6 lsof for Beta_Update with tips from Casper Dik <casper@holland.Sun.COM>.

Fixed a Solaris 2.4 TCP address reporting bug.

4.06 April 30, 1997

Added a step to the Makefile clean rules that does a make clean in the lib subdirectory; suggested by Casper Dik <casper@holland.Sun.COM>. (Configure's -clean argument already did this.)

Fixed an incorrect awk argument in the sunos*)
Configure stanza, reported by Alexandre Oliva
<oliva@dcc.unicamp.br>.

Added CD9660 (aka ISO) file system support to FreeBSD, NetBSD, and OpenBSD with mods and help from Kenneth Stailey <kstailey@disclosure.com>. (BSDI already had CD9660 support.) While at it, added file descriptor system support to BSDI and FreeBSD.

Added /kern file system support to OpenBSD. The support wasn't extended to BSDI, FreeBSD, or NetBSD, because it requires Kenneth Stailey's changes to /sys/miscfs/kernfs/kernfs.h.

Updated IRIX 6.3 support after getting access to a test system, provided by John Paul Morrison <John.Paul.Morrison@MultiActive.com>. Improved the handling of IRIX 5.1 and greater FIFOs.

4.07 May 12, 1997

Based on AIX problem reports from David Capshaw <David.Capshaw@SEMATECH.Org>, changed the aix* Configure script stanza to avoid -bnolibpath for gcc (which the GNU loader doesn't grok) and AIX below 4.1.4 (where -bnolibpath hasn't been tested or is known to be unimplemented), and to refuse to use gcc for compiling lsof in AIX versions below 4.1 (because of possible structure alignment problems). Updated 00FAQ appropriately.

Added OpenBSD support for EXT2FS. This support has yet to be tested.

Tested lsof under OpenBSD 2.1.

Activated /kern file system support for NetBSD when Configure senses that /sys/miscfs/kernfs/kernfs.h

defines the kern_target structure. This support has not been tested under NetBSD, although it has been tested under OpenBSD.

Made some simple changes to the BSDI machine.h, suggested by Jeffrey C. Honig <jch@bsd.com>.

Improved handling of alternate dialect Configure abbreviations -- aix and aixgcc, hpux and hpuxgcc, solaris and solariscc, and sunos and sunoscc.

4.08 May 23, 1997

Cleaned up dialect Makefile's, starting with a suggestion from Christopher Schanzle <chris@cam.nist.gov>.

Improved Configure's -clean processing.

Corrected bugs in Solaris lock reporting.

Changed NetBSD Configure stanza to put -I/usr/include before -I/sys.

4.09 June 1, 1997

Adjusted for latest FreeBSD 3.0 release. This required adding a new kernel name cache module for reading BSD-form hashed kernel name cache entries, rnmh.c, to the lsof library, and adding a #define to each machine.h to select it.

Activated rnmh.c for BSDI 2.1, BSDI 3.0, NetBSD 1.2, and OpenBSD 2.1.

4.10 June 8, 1997

Adjusted for Linux 2.1.x (x > 35) kernels with hashed task structure pointers. Marty Leisner <leisner@sdsp.mc.xerox.com> and Jonathan Sergent <sergent@io.com> tested the adjustment.

Replaced readdev() stat() calls with lstat() to reduce device table and cache entries with the same device number and inode values. Added code to remove all remaining duplicates. This fixes a Linux problem reported by Jonathan Sergent and makes device node name output predictable.

Corrected a bug in UnixWare stream file handling that prevented searching for the stream file by its associated character device name.

Added Pyramid code to determine Reliant UNIX clone major device number differently from that of DC/OSx.

4.11 June 12, 1997

Changed Configure to sense that the PTX `inp_[fl]addr` members of the `inpcb` structure of `<netinet/in_pcb.h>` have a struct type and set `HASINADDRSTR` for use in `PTX dnode.c` and `dsock.c` tests.

Changed PTX version 4.1.4 tests to use 4.1.3 instead. Carson Wilson `<carson@mcs.com>` reported the need to do this and tested the change.

Fixed a block device table indexing bug in `lib/rdev.c`, reported by Carson Wilson. The same bug was squashed in `pyramid/ddev.c`.

Added code to the Pyramid Reliant UNIX `kread()` function to compensate for an address boundary error in the kernel's `/dev/kmem` driver.

Verified that `lsof` compiles and works under AIX 4.2.1. Added an AIX test for the presence of NFS header files, defined `HAS_NFS` and adjusted AIX dialect sources accordingly.

Based on a suggestion from Gaylord Holder `<holder@phy.ucsf.EDU>`, added DEC OSF/1 code to auto-detect the booted file, whence kernel symbol addresses are obtained.

4.12 June 24, 1997

Corrected a device number sign extension problem in the reading and writing of device cache file. The problem was reported by Bela Lubkin `<belal@sco.com>` and he suggested a fix.

Fixed an SCO stream device lookup problem. The report and solution came from Bela Lubkin

Enhanced the `Configure` script to enable cross-configuration of `lsof`, based on suggestions from Marty Leisner `<leisner@sdsp.mc.xerox.com>`. A new documentation file, `00XCONFIG`, describes the process.

Made Pyramid OBJFS support conditional on the presence of supporting header files. Corrected

the Pyramid MkKernOpts script so it generates the necessary -D's for the Nile/Jolt architecture.

Richard Coley <rcoley@pyra.co.uk> helped.

Added another IRIX xfs_inode variant for 6.2, 32 bits, no XFS rollup patch.

Tested under UnixWare 2.1.2.

4.13 July 9, 1997

Taught Pyramid lsof to grok ttyfs vnodes with help from Richard Coley <rcoley@pyra.co.uk>. Fixed some minor bugs in Pyramid FIFO reporting. Eliminated use of the Pyramid UCB compatibility library at Richard's suggestion.

Eliminated reporting of "strange" inode numbers for SCO OSR 3.2v5.0.x HPPS files with help from Bela Lubkin <belal@sco.com>

Modified port to service name lookup to use a small number of getservbyport() calls before reading the entire map with getservent(). Changed port reporting to represent a zero as '*' to be consistent with other prt number reporting tools like netstat. Casper Dik <casper@holland.Sun.COM> suggested these changes -- the getserv*() one to improve performance for large NIS service name maps.

Changed all readdev() functions to make the absence of block devices a warning instead of a fatal error after Brian Redman <ber@ms.com> reported his IRIX 6.4 system had no block devices. (It really did have block devices, but readdev()'s lstat() use caused it to miss them in a directory symbolically linked from /dev/dsk->/hw/disk.) Fixed Brian's real problem by changing the IRIX readdev() to use stat() on /dev nodes if a Configure test shows /hw is readable. Extended the potential to do the same to all readdev() functions.

For consistency and convenience changed some Configure abbreviations and dialect subdirectory names: "decosf" abbreviation and "osf" dialect subdirectory name to "du"; "netbsd" dialect subdirectory name to "n+obsd"; "next3" abbreviation and "next" dialect subdirectory name to "ns"; "sco" abbreviation and dialect subdirectory name to "osr";

"sgi" dialect subdirectory name to "irix"; and "unixware" abbreviation and dialect subdirectory name to "uw".

Added #if/#endif clauses to the AIX rmdupdev() function to avoid clone processing for AIX versions less than 4.1.4. The problem was reported by Toralf Foerster <toralf.foerster@io-warnemuende.de>, who supplied corrective code.

Added support for new style NetBSD inode with i_ffs and i_e2fs union members.

Improved Configure and 00FAQ information on Digital UNIX configuration subdirectory with suggestions from Brad Krebs <brad@EECS.Berkeley.EDU>.

4.14 July 22, 1997

Reorganized the Solaris handling of the inode structure header file, ufs_inode.h, to eliminate VxFS structure definition conflicts for Solaris 2.4, based on information from Greg Earle <earle@netbsd4me.jpl.nasa.gov>.

Cleaned up some typos and confusion in Configure's help output, based on comments from Bela Lubkin <belal@sco.com>

Added a 00DIALECTS file, containing UNIX dialect version numbers, that can be used by Configure and the man page.

4.15 August 15, 1997

Aligned `Configure -help` output better. Removed Configure's 2.6 Beta test adjustments.

Added improved Solaris VxFS configuration and handling, based on information from Greg Earle <earle@netbsd4me.jpl.nasa.gov>.

Added socket state -- TCO or TPI -- for socket files at the suggestion of Ian Fitchet <I.D.Fitchet@ftel.co.uk>.

4.16 September 25, 1997

Added reporting of TCP/TPI queue lengths and window sizes ala netstat to NAME column. Added -T option to select or de-select TCP/TPI info reporting.

(Window sizes are only reported for Solaris.)
Fixed anomalies along the way in SIZE/OFF processing
for some dialects.

Fixed service name argument processor to allow
minus signs as part of the name. Consequently this
disallows names with embedded minus signs from
being specified as the start of a range.

Added 00FAQ entries explaining why lsof won't find
a file being edited with vi, why window sizes aren't
reported for all dialects, and what the "no more
information" message means.

Forced Pyramid CC to be /usr/ccs/bin/cc to avoid
accidental use of the BSD variant in /usr/ucb/cc.

Added support for Linux glibc2, including a Configure
test; cross-Configure support (00XCONFIG); and much
unfortunate and risky sleight-of-hand in lsof Linux
dialect header and source files, forced upon lsof
by incompatibilities between Linux kernel and glibc2
header files.

Included in scripts/identd.perl5 a Perl 5 implementation
of an identd server, using lsof, provided by Kapil
Chowksey <kchowksey@hss.hns.com>.

Updated IRIX 6.4 xfs_inode guess.

4.17 October 14, 1997

Added -V option for verbose search result reporting.
Verbose reports are prepared for failure to locate
file names, command names, Internet addresses or
files, login names, NFS files, PIDs, PGIDs, and UIDs.

Augmented Linux NFS file test to cope with kernels
whose NFS code is in a loadable module. Need for
the test was pointed out by Jonathan Sergent
<sergent@csociety.ecn.purdue.edu>. The change
required that Linux have private dmnt.c source,

Completed a Linux 2.1.57 port on a system provided
by Jonathan Sergent.

4.18 October 25, 1997

Eliminated memory leaks in alloc_ifile(), lkup_port(),
and NEXTSTEP's process_text() function.

Added recognition of OpenBSD 2.2 in Configure,
supplied by Kenneth Stailey <kstailey@disclosure.com>.

Consolidated print_file() functions to use the one
in lib/prtf.c. Made it configurable and changed
it to size print columns dynamically.

!!! WARNING !!!

WITH DYNAMICALLY SIZED PRINT COLUMNS LSOF 4.18
PRODUCES OUTPUT SIGNIFICANTLY DIFFERENT FROM THAT
OF PREVIOUS REVISIONS. LINES ARE GENERALLY SHORTER
AND THERE IS GENERALLY LESS BLANK SPACE BETWEEN
COLUMNS AND THE ITEMS IN THEM. THERE ARE NO LONGER
ANY SPACES BETWEEN DEVICE NUMBER ELEMENTS, ONLY
COMMAS.

!!! WARNING !!!

Added special types and print specification modifiers
for file size and offset to handle UNIX dialects
with 64 bit sizes and offsets. Paul Eggert
<eggert@twinsun.com> reported the need for this
addition.

With Paul Eggert's help picked lint from the lsof
library, the main level lsof sources, and the Sun
dialect sources.

Added documentation, including the file 00LSOF-L,
about the lsof-l LISTSERV.

Added support for Reliant UNIX on the RM600. Bob
Passarella <rmpassar@pyramid.com> supplied the
changes. Kevin Smith <kevin@pyramid.com> helped
arrange test systems. While incorporating Bob's
changes, modified lib/rnch.c to handle kernel ncache
structs whose name is accessed via a char *, rather
than in a char array.

Changed #include order of <sys/socketvar.h> for
Solaris 2.x. W. Richard Stevens <rstevens@kohala.com>
pointed out the need to do this.

4.19 October 30, 1997

Changed Pyramid Reliant RM600 proc scan to skip
SSYS (p_flag) processes, since they don't seem to

have a readable u_cdir vnode.

Enabled Pyramid Reliant UNIX kread() work-around for DC/OSx, too, since its read(/dev/kmem) kernel driver seems to share the page boundary bug this work-around circumvents.

Changed SzOffFtm_d and SzOffFtm_dv (new formats at 4.18 to print size and offset) from signed to unsigned. Setting them signed at 4.18 was an oversight.

Plugged a memory leak that caused the loss of 130 bytes per repeat-mode pass. Fixed it with a simple work-around in main(). Lionel Cons <Lionel.Cons@cern.ch> reported the leak.

4.20 November 11, 1997

Tested under BSDI 3.1.

Added support for Reliant UNIX Mesh IPC files with help from Billy Ho <bho@pyramid.com>.

Added support to Digital UNIX lsof that uses the libmsfs tag_to_path() function (when it exists) to look up AdvFS path names. The idea and sample code came from Dean Brock <brock@cs.unca.edu>. Converted Dean's code into more general purpose support for private name cache lookups via the HASPRIVNMCACHE #define in the dialect machine.h file and code conditional on it in the printname() function.

Taught Digital UNIX lsof to recognize NFS3 file systems. Corrected Digital UNIX lsof DEVICE column alignment.

4.21 December 1, 1997

Squashed bug, introduced at revision 4.18, that resulted in double reporting of each selected PID when terse mode (-t) was specified.

Corrected minor bug, also introduced at 4.18, that might cause an extra print_proc() pass when one PID has been specified.

Added -R to lsof options in scripts/idrlogin.perl*. The option should have been there -- it was supposed to be mandatory for PGID reporting -- but a bug,

corrected in revision 4.18, previously made -R unnecessary.

Enabled configuring for BSDI BSD/OS 4.0 per a suggestion from Jeff Honig <jch@bsd.com>.

Enabled replacement of scoff_t with off64_t (scoff_t is used to type r_size and r_localsize in the rnode struct) for IRIX 5.3 systems that have the NFS kernel rollup patch (1477). This compensates for SGI's failure to distribute an updated <sys/fs/rnode.h> with their patch.

Validated under Linux 2.0.3[12], Linux 2.1.64, and NetBSD 1.3.

Added FreeBSD root directory reporting, courtesy of Dan Nelson <dnelson@emsphone.com>.

4.22 December 15, 1997

Made adjustments for Linux 2.1.7[02].

Improved NAME information for Linux UNIX domain sockets.

Added option +|-M to control the reporting of portmapper registration information in square brackets after the TCP or UDP port or service name. Kenneth Stailey <kstailey@disclosure.com> suggested the feature and provided sample code from OpenBSD. Reporting is disabled by default in the distribution and may be enabled with +M; if lsof is compiled with HASPMAPENABLED (e.g., from machine.h), reporting will be enabled by default and can be disabled with -M.

Changed the -w option to +|-w to match the syntax of the +|-M option and to eliminate any options that flip meaning when a symbol is defined at compile time. For both +|-M and +|-w, specifying '-' when the default state is disabled or specifying '+' when the default state is enabled causes no problems.

!!!WARNING The -w option has changed in lsof 4.22. WARNING!!!

Made the +|- prefix legal for most options, but didn't document it in the man page or help panel.

Most options that disable something -- e.g., -b, -C, -n, -P -- now disable when the prefix is '-' and enable when it is '+'. Since the states these options disable are enabled by default, I chose to avoid documentation complexity and confusion by not mentioning that they can be used with the '+' prefix.

Condensed the help panel.

Made sure Digital UNIX Configure stanza puts normal include path (e.g., /usr/include) before system include paths.

Added IPX socket information reporting to Linux with help from Jonathan Sergent <sergent@purdue.edu>.

4.23 January 16, 1998

Fixed conflict arising from the quondam replacement of the Sun Solaris <netdb.h> with a BIND/BSD version.

With help from Jonathan Sergent <sergent@purdue.edu> developed a /proc file system based Linux lsof. It needs some Linux 2.1.x release to work -- I'm not sure which, but I tested under 2.1.72, 2.1.76, and 2.1.79. The Configure script selects special sources for this lsof, so the full lsof distribution now contains both /dev/kmem and /proc based sources for Linux lsof. An optional kernel mod, written by Jonathan, enhances the /proc-based lsof ability to recognize IPX socket files. Reorganized and augmented the Linux sections in 00FAQ to explain the two types of Linux lsof.

Defined DOSTAT_FUNCTION for dostat() in misc.c to select the function, stat() or lstat(), it will use. DOSTAT_FUNCTION is normally undefined, defaults to lstat(), and is only defined for the /proc-based Linux lsof in its dlsof.h.

Made conditional on the presence of IRIX 6.4 XFS rollup patch #6 an XFS node change introduced in revision 4.16. Identified the patch with help from John R. Vanderpool <fish@daacdev1.gsfc.nasa.gov>.

Added NFS node compensation for NetBSD 1.3. The code and suggestion for it was supplied by Jean-Luc Richier <richier@imag.fr>.

Added diagnostic messages to the /dev/kmem-based Linux Mksrc script to report errors during the construction of the kernel name cache header file, kncache.h. Added 00FAQ information on kncache.h.

Added a new Linux test host, running 2.0.33 and Glibc, provided by Steve Logue <stevel@mail.cdsnet.net>.

Ported to PTX 4.1.3 and 4.4.2. Adjusted lib/rnch.c for 4.4.2 to allow customization of additional ncache struct element names.

4.24 January 28, 1998

Changed /proc-based Linux lsof offset test to use "/" instead of "/etc/passwd".

To assist Jim Mintha <jim@geog.ubc.ca> with the packaging of lsof for Debian Linux, added a DEBIAN_LINUX_LSOFSO #define to trigger the activation of special system map file location code in the /dev/kmem-based dproc.c.

Applied modification to dialects/bsd/dlsof.h from Ingimar Robertson <iar@skyr.is>, enabling lsof to compile for BSDI BSD/OS 2.0.

Corrected a documentation error in 00DCACHE, pointed out by Thomas Anders <anders@hmi.de>. The error was created when the -V option was added at lsof 4.17.

Made IRIX 5.3 through 6.3 lsof aware of IRIX SCSI tape devices (e.g., /dev/tape). Dave Olson of SGI and Randolph J. Herber of FNAL provided valuable advice, and Igor Schein <ischein@air-boston.com> helped test.

Added a machine.h symbol (NEVER_HASDCACHE) that prevents Customize from offering to change HASDCACHE. The symbol may appear anywhere in machine.h -- e.g., in a comment. Included the symbol in a comment of the HASDCACHE section of the /proc-based Linux lsof machine.h, and accompanied it with warnings against #define'ing HASDCACHE. Did the same thing for WARNDEVACCESS (NEVER_WARNDEVACCESS is the suppressant.)

4.25 February 7, 1998

Corrected an IRIX mis-cast of file offset (position).
Igor Schein <ischein@air-boston.com> reported the problem. This was offered as a patch to 4.24.
Picked some lint Igor pointed out.

At Igor's suggestion added an optional decimal digit size argument to the -o option. This argument specifies how many file offset decimal digits can follow "0t" before lsof switches to a "0x..." form. The argument size specification doesn't count the two characters of the "0t". A size of 0 means unlimited. The default is OFFDECDIG (8), preserving compatibility with existing lsof output; it can be changed by the lsof builder. When size is specified with -o it does not force offset display; -o without a size still must be used to do that.

Added an IRIX 6.2, 32 bit system, XFS node patch, courtesy of Ulrich Bernhard <rzubu@rzu.unizh.ch>.

For my own convenience enabled Configure to use /usr/local/bin/gcc for NEXTSTEP. This allows circumvention of a gcc 2.8.0 ranlib problem on my test 3.1 `040 cube.

Added flags recommended by the RISC/os and Ultrix compilers for the updated (and longer) main.c.

Updated FreeBSD cd9660_node.h Configure test.

4.26 February 17, 1998

Added shared process group processing for IRIX 5.3, and IRIX 6.1 and above, based on investigation of a bug report from Igor Schein <ischein@air-boston.com>. Igor helped test this addition.

Improved handling of file system name arguments. It's now done in a manner similar to fuser. The -f argument forces path names to be considered as simple files, rather than as file system names. The +f flag forces them to be considered as file system names. Normally path arguments are considered file system names when they match a mounted-on directory in the system's mount table, or when they match a mounted file system's block device. Igor Schein helped test this change.

Igor also suggests that the proper compilation of

the IRIX 6.4 proc structure after patch 2536 has been installed may need -DPIOMEMOPS. So lsof's MkKernOpts script was updated to propagate that option from CCOPTS in /var/sysgen/system/irix.sm, even though patch 2536 doesn't add -DPIOMEMOPS to it. Added a 00FAQ item on this patch.

Added a fatal warning message about names forced to be file system names (with +f) that have no match in the mount table.

Improved the -V message for files and file systems for which no open files were found. Added reporting of /proc file and file system search failures.

Did some code reorganization to combine the multiple ck_file_arg() functions into one. Moved the new function from the library to the top level and put it in arg.c; moved the usage function from arg.c to a new top-level source file, usage.c, to balance top-level source file size. The new usage.c depends on version.h; arg.c no longer does.

Added flag recommended by the DU compiler for the updated (and longer) main.c.

4.27 March 6, 1998

At the request of Igor Schein <ischein@air-boston.com> added a conditional repeat mode option, using the '+' prefix to the 'r' option. +r operates as does -r with the exception that it exits the first time no open files have been listed during a cycle. The exit code will be zero when any open files have been listed; one, if none were ever listed.

Ported lsof to HP-UX 11.0 with the help of Richard Allen. This port hasn't been tested on a 64 bit kernel; I'm sure it won't work there without more mods. It may not work on PA 2 architectures; I've only tested it under PA 1 and a separate, busy tester reported PA 2 problems that I've been unable to investigate.

In anticipation of getting access to a 64 bit HP-UX kernel and the pending start of the Solaris 2.7 Beta test (It will have 64 bit kernel addressing.), started adding support for 64 bit kernel pointers. This includes: ubiquitous use of the KA_T cast

for kernel pointers; a format to print them,
KA_T_FMT_X; a function to print them, print_kptr();
and modifications to most kernel-related functions
-- e.g., process_file(), process_node(),
process_socket(), readvfs() -- to process kernel
addresses as KA_T types.

Fixed minor bug in handling path name arguments
that end with a `/'.

Removed support for RISC/os; its test system is no
longer available.

Made modifications to insure that lsof output
doesn't contain non-printable characters. All such
characters are now printed in the printf form
"\x%02x". Several new common functions were
installed in misc.c to support "safe" printing.
This second major modification in 4.27 to common
and dialect code could have introduced bugs not
yet detected.

4.28 March 10, 1998

Refined unprintable format to use \b, \f, \r, \n,
\t, and ^* (for CTRL) forms. Corrected omission
of safestrprt() use for field output command name.
These changes were offered as patches to 4.27.

Made space an unprintable character (\x20) in the
COMMAND column; printable elsewhere, including the
NAME column, field output, and error messages.

Made sure FD column is parseable as a single entity
-- i.e., has no embedded space. Thus, if the access
mode is unknown but there is a known lock mode, (a
very rare case) the access mode will be printed as
`-'.

Picked lint with gcc 2.8.0 under Solaris 2.6.

With the help of Dave Olson of SGI identified a
proc struct element that should have been added to
<sys/proc.h> by IRIX 6.4 patch 2536. Added a
work-around for it to the lsof Configure script.
Igor Schein <ischein@air-boston.com> identified
that the patch caused a proc structure length
complaint from lsof. Removed an obsolete OOFAQ
item on the patch, installed at lsof 4.26, explaining

that no solution was yet available.

Added a 00FAQ item on how BIND installs its own header files, including <netdb.h>, which may cause the rpercent struct definition to vanish. Solaris has an automatic lsof work-around, but that hasn't been (and probably can't be) propagated to all dialects supported by lsof. The 00FAQ item recommends re-installation of the vendor header files that BIND has replaced. (Others include <rpercent.h>, <sys/bitypes.h>, and <sys/ctypes.h>.)

Made AIX AFS fixes.

4.29 March 26, 1998

Corrected bug in Internet address matching. The matching formerly stopped if the foreign address matched, thus failing to check the local address for a match. That led to a possible false "Internet address not located" warning (i.e., in response to -V) about the local address, when both foreign and local addresses were specified with -i. This correction was offered as a patch to 4.28.

Changed readmnt() usage in an attempt to defer mount readlink() and stat() delays until they are necessary.

Corrected two bugs in the Digital UNIX readdev() function. Made the correction available as a patch to 4.28 and regenerated the 4.28 DU binaries.

Added a missing argument to a print-kptr() call in the HP-UX dsock.c. The missing argument causes a fatal gcc error. The problem was reported by Eyal Shaynis <eyal.shaynis@telrad.co.il>. The fix was offered as a 4.28 patch.

Adjusted for Digital UNIX 4.0D; the spec_node structure is now defined in <sys/specdev.h>. Kris Chandrasekhar <Kris.Chandrasekhar@digital.com> identified the need for the adjustment.

Incorporated a bug fix from Brian McAllister <mcallister@mit.edu> to the DU readmnt() function. This fix was offered as a patch to 4.28.

Added "safe" printing to a SunOS clone device error

message.

Corrected bug in tabling of Linux /proc-based lock info.

Corrected bug in handling of SunOS TLI streams.
Dan Farmer <zen@trouble.org> reported the problem.

Added a Solaris 2.6 work-around to keep the BIND <sys/bitypes.h> from colliding with the Solaris <sys/int_types.h>.

Strengthened the Configure test for /proc-based Linux lsof, based on a report from Marty Leisner <leisner@sdsp.mc.xerox.com>.

Tested on OpenBSD 2.3.

Made AIX changes that allow use with 3.2.5. The changes were suggested and tested by Brett Hogden <hogden@rge.com>.

Added Solaris 2.6 AFS support. Disabled reporting of some node numbers for Solaris 2.5 and above open AFS files. The node number computation algorithms used for SunOS 4.1.x and Solaris less than 2.5 no longer always work under Solaris 2.5 and above.

4.30 April 9, 1998

Corrected a pid structure member naming error for UnixWare < 2.1.2. The problem was reported by Richard van Meurs <vanmeurs.anva@atriserv.nl>. He supplied the correction. This was offered as a patch to 4.29.

Had a report from Igor Schein <ischein@air-boston.com> that IRIX 6.4 patch 2839 is another SGI kernel patch, along with 2536, that changes the size of the proc structure in the kernel without changing the proc structure in <sys/proc.h>. Upon further investigation found that the effect of these patches on the proc structure is not consistent. Therefore, dropped the Configure patch test for IRIX 6.4 and made the code in irix/dproc.c slightly more tolerant of proc structure size differences for IRIX 6.4. Igor help test the change.

Corrected Solaris >= 2.5 AFS inode number generation.

Craig Everhart <Craig_Everhart@transarc.com> helped find the cause of the problem. This was offered as a patch to 4.29.

Refined the Linux /dev/kmem-based glibc evasion for the timeval structure to make it work with glibc version 2.0.7. This required defining a new global symbol, TIMEVAL_LSOF, default timeval, that the /dev/kmem-based Linux lsof can set to its private glibc timeval name, distinct from the kernel timeval name.

Added support for Alpha to the /dev/kmem-based Linux lsof. Alexandre Oliva <oliva@dcc.unicamp.br> provided a test system. Added an item to 00FAQ about lsof, the Alpha processor, and Linux.

Added a 00FAQ item about lsof year 2000 compliance. Basically it says lsof is probably compliant, because its only date or time computations are done with time_t values, but I haven't done any specific Y2K validation. I don't have plans to do any.

Added support for UnixWare 7. Chris Daniels <chrisd@dlpco.com> provided a test system and Don Draper <dond@sco.COM> provided technical information. Added BFS and SFS file system support to lsof for UW 2.1.[12] and 7.

Updated Solaris VxFS support for VxFS 3.2.1. Greg Earle <earle@netbsd4me.jpl.nasa.gov> reported the need for the update. Greg and Roger Klorese <rogerk@veritas.com> provided technical information. Scott McClung <mcclung@primenet.com> tested.

Changed IRIX XFS patch detection in anticipation of learning there are multiple XFS patches for IRIX 6.4 that require different versions of the lsof-invented xfs_inode structure.

4.31 April 21, 1998

Added a VxFS #if/#endif wrap to a section of the HP-UX dnode.c that wasn't properly protected. The problem was reported by Peter Klosky <PKlosky@bdm.com>. This was offered as a patch to 4.30.

Added support for Solaris 2.7 (first Beta release). Mike Sullivan <Mike.Sullivan@Eng.Sun.COM> provided

technical advice and helped test. Charles Stephens <cfs@jurassic.eng.Sun.COM> also helped test.

Fixed bug in /proc-based Linux that caused it to access /proc/mounts excessively. Marty Leisner <leisner@sdsp.mc.xerox.com> provided a syscall trace that identified the bug. The fix was offered as a patch to 4.30.

Adjusted the IRIX 6.4 private structure definition for the XFS node to accommodate patch 2970. Igor Schein <ischein@air-boston.com> identified the patch and the required adjustment.

4.32 May 11, 1998

Corrected Solaris 2.7 code for reporting PCFS (floppy disk) node numbers. Casper Dik <casper@holland.sun.com> supplied the fix. The fix was offered as a patch to 4.31.

Corrected a bug in conditional repeat mode handling pointed out by Igor Schein <ischein@air-boston.com>. This was offered as a patch to 4.31.

Improved reporting of AIX open(/dev/memory device) errors.

Corrected a Solaris < 2.5 KA_T declaration error, pointed out by Robert Kiessling <robert@easynet.de>. Changed KA_T from a #define to a typedef for all dialects to prevent future problems of this kind.

Changed the sample Perl 5 script big_brother.perl5 to report a four digit year from localtime().

Added support for AIX 4.3[.1]. Bill Pemberton <wfp5p@tiger.itc.virginia.edu> provided a test system. Andrew Kephart <akephart@austin.ibm.com> and Tom Weaver <tvweaver@austin.ibm.com> provided technical assistance. Niklas Edmundsson <nikke@ing.umu.se> did 4.3.1 testing.

Added -qmaxmem option to CFLAGS for an AIX compilation with an xlc version 4.x compiler.

Adjusted Linux socket handling for changes in the AX25 members of the sock struct. Richard Green <rtg@tir.com> pointed out the problem. Tested

/dev/kmem-based lsof under Linux 2.0.34.

4.33 May 22, 1998

Added generic IPv6 support to common lsof sources and specific IPv6 support to AIX sources. Andrew Kephart <akephart@austin.ibm.com> supplied the additions and helped with testing. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system. The modification affected sources for every dialect, whether it supports IPv6 or not, by changing the interfaces to the common Internet address function `ent_inaddr()`.

Added support for the NetBSD UVM virtual memory system. Paul Kranenburg <pk@cs.few.eur.nl> supplied technical details.

Bracketed HP-UX 11 use of <sys/spinlock.h> with `#if/#endif _KERNEL`.

Corrected printing of PCB address in DEVICE column for IRIX.

4.34 June 26, 1998

Updated 00FAQ to discuss TCP and UDP ports private to the AIX kernel and 00README to describe how ACLs can be used to give lsof permission to read the kernel memory devices. Add information to 00FAQ and 00README about other OpenBSD architectures where lsof is reported to compile and run. Added section to 00FAQ discussing how an incorrect loader path environment variable value can prevent lsof from loading correctly.

Improved Solaris namefs and doorfs support so that it is now possible to search for an open VDOOR file by the path name of its fattached file system object. Igor Schein <igor@txc.com> requested the ability to do such a search. Even with the change, lsof can't always identify path names for open VDOOR files.

Also at Igor's request, improved reporting of information on open Solaris VCHR files that share a common vnode, and Solaris UNIX domain socket files.

Corrected `print_kptr()` argument error in PTX `dnode.c`,

reported by Mark Price <mprice@sequent.com>.
Compensated for ncache element naming differences,
introduced at PTX 4.4.2; Kurtis D. Rader
<krader@sequent.com> reported the problem.

Changed output column title from INODE to NODE to
better reflect the column's contents of node IDs
for more than just inodes.

Improved Configuration and processing for Solaris
AFS. Corrected AIX AFS 3.4 afs_rwlock_t simulation.

Corrected a cast problem with two AIX knlist()
calls, thus quieting an AIX 4.2.1 compiler argument
type warning. Jon Champlin <champlin@us.ibm.com>
reported the problem.

Added support to most dialect versions (exception:
/proc-based Linux) to warn when the identity of
the kernel where lsof was compiled doesn't match
the running identity. The warning can be suppressed
with -w. Note: determining AIX state requires
calling oslevel, a potentially slow operation.
Jon Champlin <champlin@us.ibm.com> suggested this
addition.

!!!! WARNING !!!! !!!! WARNING !!!! !!!! WARNING !!!!

Those using the lsof cross-configuration capability
(see 00XCONFIG), should be aware that the kernel
identity test feature introduces two new basic
cross configuration environment variables, LSOF_ARCH
and LSOF_VSTR.

!!!! WARNING !!!! !!!! WARNING !!!! !!!! WARNING !!!!

Identified a situation where a Solaris UNIX domain
socket name is known and can be searched for by
name; added the necessary code.

4.35 July 17, 1998

Made the kernel identity check an option with the
HASKERNIDCK #define in machine.h. Enabled altering
of HASKERNIDCK with the Customize script. Added
a clause to the help output that indicates the
build-time HASKERNIDCK status.

Added more information to the NAME column for

Solaris UNIX domain sockets. Made them searchable by their clone device path name. Igor Schein <igor@txc.com> requested this.

Completed the HP-UX 11 port with support for its optional 64 bit kernel. Rich Rauenzahn <rrouenza@cup.hp.com> provided a test system. Corrected errors with HP-UX 11 lock reporting and private kernel structure and type definitions. Added support for HP-UX NFS3 files.

Limited mount table warnings -- e.g., when -b is used -- to one set per mount point.

Fixed some mount table scanning and usage bugs, including one in Solaris, reported by Kjetil Torgrim Homme <kjetilho@ifi.uio.no>.

4.36 August 4, 1998

Made corrections and additions to IPv6 support and to AF_ROUTE socket handling, supplied by Jean-Luc Richier <Jean-Luc.Richier@imag.fr>. Jean-Luc's additions provide IPv6 support for the Inria IPv6 implementations on FreeBSD and NetBSD.

Fixed two Solaris 2.5, 2.5.1, 2.6 and 2.7 TCP and UDP host name or IP address reporting bugs, reported by James Mathiesen <James-Mathiesen@deshaw.com>. This fix was offered as a patch to 4.35.

Updated the Customize script to cause ENTER to use all defaults. Amir J. Katz <amir@ndsoft.com> suggested this and helped test the changes.

Updated Solaris ICMP and IP stream handling, based on a report from Igor Schein <igor@txc.com>.

Fixed a bug in the Digital UNIX mount table handling, reported by Bob Ward <bward@thehartford.com>. While working on the bug, found and updated some obsolete AdvFS code. This fix was offered as a patch to 4.35.

4.37 September 15, 1998

Deactivated SGI IRIX support and archived revision 4.36 sources and binaries in pub/tools/unix/lsof/OLD.

Improved performance of FD searching. This was

offered as a patch to 4.36.

Amir J. Katz <amir@ndsoft.com> pointed out that ranlib isn't needed for AIX or Solaris. Made appropriate Configure script changes.

Fixed a file offset reporting bug for HP-UX VCHR and VBLK device nodes located on a VxFS root. Doug Siebert <douglas-siebert@iowa.edu> reported the bug. The fix was offered as a patch to 4.36.

Resolved an HP-UX root device name reporting bug, partly caused by an out-dated local copy of the <sys/mount.h> mount structure, by generating a local header file with the structure that can be compiled without needing _KERNEL defined. Doug Siebert also reported this bug.

Changed some dialect source code -- Digital UNIX, Solaris, SunOS, and UnixWare -- to make more consistent with ps the user ID lsof reports in the USER column. Added a 00FAQ entry about it. Igor Schein <igor@txc.com> reported the Solaris and SunOS lsof inconsistencies with what ps(1) reports.

Ported lsof to Pyramid ReliantUNIX 5.44.

Added brackets as comments to case, do, done, else, endif, esac, if, and while statements in Configure to assist in navigating its clauses.

Added more Linux 2.0.x glibc work-arounds.

Added support for UnixWare 7.0.1.

Ralph Forsythe <ralph@contact-paging.com> provided a new FreeBSD test system.

4.38 November 25, 1998

Added support for recent FreeBSD 3.0 distributions. A 3.0 test system was provided by David O'Brien <obrien@NUXI.com>. This was offered as a patch to 4.37.

Updated the scripts/idrlogin.perl* files to look for sshd processes in addition to rlogind and telnetd ones.

Added support for DU 5.0 Beta. Berkley Shands <berkley@cs.wustl.edu> provided a test system.

Added support for OpenBSD 2.4 with changes supplied by Kenneth Stailey <kstailey@disclosure.com>.

Changed the Solaris 2.7 tests and documentation to Solaris 7.

Made some changes to the header files for NEXTSTEP 3.3 and added support for OPENSTEP 4.x with help from Michael A. Hovan III <mhovan@BLaCKSMITH.com> and Carl Lindberg <Carl_Lindberg@BLaCKSMITH.com>. The combined dialect subdirectory is named n+os. One of Carl's changes propagates RC_CFLAGS to the library Makefile. Timothy J. Luoma <luomat@peak.org> helped test under NEXTSTEP 3.3 and OPENSTEP 4.2.

Made UW 7.x version sensitive to the presence of ptf7038. Added peer PCB address to Unix domain socket Name column, even when a path name has been located. Information for these changes was supplied by Francis Le Bourse <flebourse@intelcom.fr>. Lee Penn <lee@dlpco.com> provided a test system.

Tested lsof under OSR 5.0.5 on a test system also provided by Lee Penn.

Made path name argument processing more tolerant of errors per a suggestion from Julian Gordon <julian@cadence.com>.

Acquired a new UnixWare 2.x test system, generously provided by Computer Classroom, Inc. -- Matthew Thurmaier <matt@compclass.com>, Ken Laing <ken@compclass.com>, and Andrew Merrill <andrew@compclass.com>. Updated Configure to accept a UnixWare version of 2.1.3.

Updated kmem-based lsof for Linux 2.0.36.

Updated NetBSD sources for a change in a UVM virtual mapping header file.

Corrected a cache allocation bug in Sun format kernel name cache handling. The bug only shows up when the kernel name cache is inaccessible.

4.39 December 29, 1998

Corrected problems with large device number handling for 64 bit Solaris 7. The problems were reported by Steve Bellenot <bellenot@math.fsu.edu>. Steve helped test the fixes. The fixes were offered as two patches to lsof 4.38.

Improved FreeBSD Configure operations for header files that must be obtained from the kernel source tree, based on a suggestion from David O'Brien <obrien@NUXI.com>.

For Bela Lubkin <filbo@deephought.armory.com> made optional with +f[cfn] the display of file structure address, shared use count, and node structure address. /proc-based Linux doesn't implement this feature, because it doesn't read kernel structures from kernel memory. Modified the PTX -X option to take advantage of the new file structure display option. Added shared.perl5 to the scripts/ subdirectory to provide an example of how +f[fn] might be used to track shared file descriptors and files.

Added more /dev/kmem-based Linux glibc evasions, provided by Jeff Johnson <jbj@redhat.com> and Maciej Lesniewski <nimir@kis.p.lodz.pl>. Jeff helped test them on various Linux architectures.

Tested on AIX 4.3.2; no changes were required. Doug Crabill <dgc@purdue.edu> provided a test system.

Fixed -c option to detect missing command name when following option begins with `+'.

4.40 January 25, 1999

Added support for using the CDS compiler for Reliant Unix 5.44 and above. Made Reliant Unix MIPC support optional, dependent on the presence of <sys/mipc.h>.

Based on a report from Michael Schmitz <MSchmitz@lbl.gov> that /dev/kmem-based lsof misbehaves on a Linux 2.0.x m68k kernel without module support, made the absence of query_module() or get_kernel_syms() Linux kernel support a fatal error. Updated relevant sections of 00FAQ to reflect the change.

Added the ability to force the Linux Configure stanza to use the /proc or /dev/kmem source base via a LINUX_BASE environment variable specification. This is a cross-configuration assist.

Added "+D <dir>" and "+d <dir>" options for directory searching. +D searches the entire tree, starting at <dir>, including <dir>, its contents, and its subdirectory branches; +d searches only <dir> and its contents, but not its subdirectory branches. Improved lsof's searching of the specified name list to compensate for anticipated long lists from +d and +D.

Made an egrep in the Solaris Configure stanza usable by the standard and XPG4 egrep's. Kenneth Stailey <kstailey@disclosure.com> pointed out the improvement.

Fixed bugs in /dev/kmem-based Linux and UnixWare Unix domain socket name searching.

Changed a Linux Alpha #include to be conditional on the presence of its named header file, so that lsof will compile on Red Hat 5.1 and 5.2 (Linux kernel 2.0.35) where the header file is absent. The problem was reported by Alexandre Oliva <oliva@dcc.unicamp.br>.

Fixed an AIX 4.3+ bug in procinfo struct space allocation, reported by Jeff Stewart <jws@purdue.edu>. This was offered as a patch to 4.39.

Added an lstatsafely() function to offer the same isolation for lstat() calls that statsafely() offers for stat() calls. This made DOSTAT_FUNCTION no longer necessary, so deleted it.

With help from Laurent P. Montaron <lpm@sequent.com> ported lsof to PTX 4.4.4. Laurent did a monumental job of identifying TCP/IP changes by their TCP version, rather than by their PTX (With mix 'n match PTX and TCP/IP versions, the PTX version often has no bearing on the TCP/IP version.), and changed the Configure script and pre-processor #if/#else/#endif blocks to match. He also updated Unix domain socket handling for PTX TCP/IP versions 4.5 and above.

Updated CLIENT handle acquisition of fill_portmap() in print.c to use the more modern RPC function clnt_create() in place of clnttcp_create() where possible. PTX 4.4.4 requires clnt_create().

4.41 February 27, 1999

Added FreeBSD 3.1 and 4.0 support with help from Sheldon Hearn <axl@iafrica.com>, David O'Brien <obrien@NUXI.com>, and John Polstra <jdp@polstra.com>.

Corrected bungled AIX 4.3+ patch that went into lsof 4.40.

Reorganized the Configure script to improve Makefile construction. A specific impetus for this was to allow FreeBSD system-wide make flags to be propagated to the lsof Makefiles, but other goals were to make sure that the DEBUG= make entry can over-ride standard CFLAGS values, and to better manage the identification of compilers and their versions. Two compiler-related values may now be supplied in environment variables: 1) the compiler path in LSOF_CC; and 2) the compiler version in LSOF_CCV. 00XCONFIG documents them.

Added support for Pyramid Reliant Unix bsdfs, mssockfs, and sockfs file systems.

Added an optional LSOF_CINFO string to Configure, producing a CINFO string in selected Makefiles, producing a #define LSOF_CINFO in selected version.h header files. The purpose of this is to allow Configure the option to propagate information to the lsof -v output. It is now used for Linux to identify the code base, and for HP-UX 10.30 and 11.0 and Solaris 7 to identify the kernel bit size.

Added system information to NEXTSTEP and OPENSTEP -v output, from the second line of hostinfo's output.

Fixed a login name buffer overflow problem in the processing of -u option values. This was offered as a patch to 4.40. **!!!THIS IS A SERIOUS STACK OVERFLOW BUG; A LINUX EXPLOIT EXISTS FOR IT THAT OPENS A BASH SHELL WITH LSOF'S AUTHORITY -- E.G, SETGID(KMEM) POWER!!!**

Improved the Solaris mount table filter so the volume manager's fake mount point, "/vol", is ignored and doesn't supplant "/" in NAME column path assemblies. Igor Schein <igor@txc.com> reported this bug and provided important help in finding it. This was offered as a patch to 4.40.

Changed the Linux /dev/kmem-based lock ownership test to answer a problem reported by Tom Christiansen <tchrist@jherreg.perl.com>. This was offered as a patch to 4.40.

Installed an HP-UX 11 patch, suggested by Kevin Vajk <kvajk@cup.hp.com>, that adjusts a private lsof kernel header file, derived via Q4, to correspond to an HP-UX patch bundle.

Made NetBSD 1.3I sockproto structure adjustment.

4.42 March 30, 1999

Fixed a typo in the HP-UX dfile.c that caused +fF and +fN output controls to swap effect.

Enabled for OpenBSD 2.5 per notice from Kenneth Stailey <kstailey@kstailey.tzo.com>

Made more VM accommodations for FreeBSD 4.0.

Improved file system search reporting to include path name components when they're available, instead of mindlessly reporting the file system name in the NAME column. Guy Dallaire <gdallair@geocities.com> brought the need for this change to my attention.

Updated Solaris 2.6 VxFS for Veritas Oracle Database Edition 2.0, VxFS version 3.3, and VxVm version 2.5.4, based on a report from Chris Kordish <chris.kordish@East.Sun.COM>. Chris kindly provided a test system.

Improved HP-UX ipc_s patch detection in Configure, response in ../dialects/hpux/hpux11/ipc_s.h, and documentation in 00FAQ, Kevin Vajk <kvajk@cup.hp.com> helped test.

Added to Customize the option to suppress HASKERNIDCK selection for specified dialects. Suppressed it for /proc-based Linux lsof, and removed its test

and code from there. Tin Le <tin@netimages.com> alerted me to the need for this update.

Ported to official Digital UNIX 5.0 release.

Changed DU lsof to use the knlist(3) function when no kernel file has been specified with -k. This change was suggested by Erich Wimmer <Erich.Wimmer@digital.com>.

Updated Configure for latest NetBSD (1.3I?) with UVM support the default.

4.43 May 11, 1999

Corrected a typo in the Solaris gcc discussion in 00FAQ. Made changes to the Solaris 2.5[.1] private tcp_s structure. Both changes were done in response to reports from Igor Schein <igor@txc.com>, who tested the Solaris 2.5 change.

Made more IPv6 adjustments to lsof for Tru64 UNIX (Digital UNIX) 5.0, based on information obtained from Compaq by Berkley Shands <berkley@cs.wustl.edu>.

Corrected HP-UX error message about HP-UX 11 q4 usage. Amir Katz <amir@ndsoft.com> reported the correction.

Fixed a Glibc 2.1 conflict in /proc-based Linux lsof.

Fixed a man page typo reported by Vlad Harchev <hvv@hippo.ru>.

Changed some Solaris 2.7 references to Solaris 7 in Configure and 00EXPORTING.

Added a Solaris example to the echo statements that are the install rule in the SunOS/Solaris Makefile.

Added a field to the file structure output -- FILE-FLAG (file structure open flags, f_flag[s], and process file flags, typically u_pofile) -- enabled with +f[gG]. Its field output character is 'G'.

Figured out another piece of the HP-UX 11 patched ipc_s structure puzzle with the help of Keith Kalet <KEITH_KALET@HP-USA-om41.om.hp.com>.

Fixed a PTX real vnode to real inode interpretation bug.

Added link count to lsof output. Eric Dumazet <dumazet@risgw.ris.fr> requested and helped test it. The new +L option enables and filters it. Its field output character is `k'.

Updated Configure script to recognize NetBSD 1.4.

Updated AFSConfig to handle default answers to questions.

Incorporated patch from Jonathan Sergent <sergent@io.com> that enables /proc-based Linux lsof to run on both 32 and 64 bit kernels.

Updated Configure script with a patch from David O'Brien <obrien@NUXI.com> that recognizes FreeBSD 3.2.

4.44 June 24, 1999

Corrected use of nlink member of hsnode for SunOS 4.1.x High Sierra File System files. John Dzuber <zube@tlaloc.stat.colostate.edu> reported the problem and helped test the fix. Also fixed a SunOS segmentation fault bug. These fixes were offered as a patch to 4.43.

Improved handling of /proc-based Linux UNIX PCB address.

Fixed a NEXTSTEP and OPENSTEP bug that made repeat option (-r) processing malfunction. This fix was offered as a patch to 4.43.

Fixed Configure so it doesn't use -O in the Cflags for the bundled HP-UX C compiler. Jim Ankenbrandt <jankenbrandt@penton.com> reported the problem.

Corrected output ordering of parent PID and process group ID when both -R and -g are specified.

Enhanced the pdev.c and pdvn.c library modules for wider use. These dialect versions use the new library modules: DEC OSF/1, Digital UNIX, and Tru64 UNIX; Pyramid DC/OSx and Reliant UNIX; SCO OSR and UnixWare; and Sequent PTX.

Added basic clone device support to /dev/kmem-based HP-UX lsof for HP-UX 10.30 and higher.

Added raw socket support to /proc-based Linux lsof.

Changed NODE-ADDR column title to NODE-ID in anticipation of using more general identification information in the column.

Ported to UnixWare 7.1, using a test system kindly provided by Matt Thurmaier <matt@compclass.com> and Don Draper <dond@sco.com>.

Updated for NetBSD 1.4C VM changes, and a new current and root working directory structure.

Made minor adjustment for latest Tru64 UNIX 5.0 Beta release.

4.45 July 30, 1999

Fixed quoting problem in DEC OSF/1, Digital Unix, and Tru64 UNIX Makefile's install rule. The problem was reported by Berkley Shands <berkley@cs.wustl.edu>.

Fixed bug in Tru64 UNIX 4 lsof that caused FDs to be skipped. These fixes were offered in a patch to 4.44.

Fixed a repeat-mode /proc-based Linux lsof bug, reported by Sami Farin <sfarin@ratol.fi>. This was offered as a patch to 4.44.

Picked lint, some reported by Sami Farin.

Corrected a 00DCACHE documentation error in a sample shell script. The problem was reported by Chad R. Larson <chad@larsons.org>. Changed commented-out entries in machine.h files so they require more thought and work when the comments are removed, based on a remark by Chad.

Compensated for the practice of Solaris 7 and above to record the dev= value in /etc/mnttab in 32 bit mode, even on 64 bit systems. This was offered as a patch to 4.44.

Added a C library test for /proc-based Linux lsof, so that the #include files can be adjusted for a non-Glibc environment. The need for this was

reported by Andrew Hill <andrewh@tirin.openworld.co.uk>.
This was offered as a patch to 4.44.

Added support for Auspex LFS 1.8.1 and 1.9.2 to SunOS 4.1.4 lsof. The support was requested by Quentin Fennessy <quentin@dvorak.amd.com>, who provided information and did testing.

Enabled IPv6 support code for NetBSD and OpenBSD, conditional on Configure script tests. Wolfgang Rupprecht <wolfgang@wsrcc.com> supplied the NetBSD code and tested it. The OpenBSD code I constructed has been compiled but not tested.

Updated the identd Perl 5 script, based on a report from Wendy Lin <af5@taiyang.cc.purdue.edu> that the space in its response line in front of the user name violates RFC 1413.

Added IPv6 support to /proc-based Linux lsof. Jonathan Sergent <sergent@ETLA.NET> and Andrew Thomas Sydelko <sydelko@ecn.purdue.edu> kindly provided a test system.

Updated man page description of AIX multiplexed files to indicate that they might be /dev/ptc or /dev/pts, depending on the AIX version. The correction was suggested by Onno van der Linden <onno@simplex.nl>.

Sylvain Robitaille <syl@alcor.concordia.ca> reports lsof passes his Y2K tests.

4.46 October 23, 1999

Corrected /proc-based Linux lsof to detect that an IPv6 address is a mapped IPv4 address. The problem was reported and analyzed by Arkadiusz Miskiewicz <misiek@misiek.eu.org>, who also tested the fix.

Added a libc5 library /dev/kmem-based Linux lsof circumvention, supplied by Jason Lingohr <lingman@lucid.net.au>.

Corrected a bug in -t (terse) AIX output, reported by Wendy Lin <af5@taiyang.cc.purdue.edu>. I introduced the bug at revision 4.43 when adding FILE_FLAG reporting. This was offered as a patch to 4.45.

Added a work-around for a problem in the OpenBSD 2.3 <sys/pipe.h> header file. Volker Borchert <bt@tekon.de> provided and tested it.

Improved description of cross-building lsof for a 64 bit Solaris 7 system on a 32 bit system with suggestions from Phillip Edwards <Philip.Edwards@sn.wpafb.af.mil>.

Fixed a gawk POSIX-mode pattern error in the Linux /dev/kmem-based Mksrc script, based on a tip from Ambrose C. Li <acli@mingpaoxpress.com>.

Fixed a bug in the Tru64 UNIX IPv6 handling, courtesy of a report from Casper Dik <casper@holland.sun.com>.

Enabled support for OpenBSD 2.6.

Enabled support for BSDI BSD/OS 4.1, based on a report from Jeffrey C Honig <jch@bsd.com> that only a Configure script change is necessary.

Enabled Configure script to use gcc for building lsof for a 64 bit Solaris 7 and 8 kernels, if the gcc version is 2.95 or above.

Improved -i option handling for systems with IPv6 support so that it will search for a host name in both IPv4 and IPv6 families, when that is possible. As a companion modification, changed -V processing to report a single error when a multiple host name match is requested. Casper Dik <casper@holland.Sun.COM> helped test.

Fixed a DEC OSF/1, Digital UNIX, Tru64 UNIX repeat mode bug, reported by Mayer Ilovitz <mayer@cooper.edu>. Mayer helped test the fix. The fix was offered as a patch to 4.45.

Changed Solaris socket file recognition scheme, so it is (nearly) the same through Solaris 8, where the previous clone device scheme no longer works.

With significant assistance from Casper Dik, added support for Solaris 8 Beta and Beta refresh. The IPv6 support in Solaris 8 is still in some flux, so there are temporary compensations for the

differences between Beta IPv6 support and Beta refresh IPv6 support. Casper and I hope those differences disappear by FCS.

Improved the delivery of information on Solaris 2.5.1, 2.6, 7, and 8 door files.

Fixed a repeat mode bug that surfaces when /etc/passwd changes between cycles. The bug report and diagnostic help were supplied by Igor Schein <igor@txc.com>. The fix was offered as a patch to 4.45.

Added support for INRIA IPv6 to NetBSD. Jean-Luc Richier <Jean-Luc.Richier@imag.fr> provided patches and a test system on which to verify them.

Added support for AIX 4.3.3. Jeff W. Stewart <jws@anaconda.cc.purdue.edu> provided a test system.

Made adjustments for FreeBSD 4.0-current.

Improved reporting of information for AIX sockets that lack protocol control blocks.

4.47 November 29, 1999

Based on a query from Jean-Pierre Radley <jpr@jpr.com>, changed the lsof top-level Makefile to propagate CFGF to the library Makefile. (DEBUG was already being propagated.) Added osrgcc and scogcc Configure abbreviations (to use gcc) for Jean-Pierre.

In response to a query from Igor Schein <igor@txc.com>, improved the Configure script test for Solaris 7 and 8 that decides if the compiler can produce 64 bit executables.

Made an ugly hack, based on making a private rnode structure definition from q4 output, to compensate for HP-UX 10.20 and lower recent NFS3 patches. HP didn't supply an updated <nfs/rnode.h> with the patches. The problem was reported by Will Partain <partain@mekb2.sps.mot.com>. Elias Halldor Agustsson <elias@hi.is> helped identify the patches as PHNE_18173, PHNE_19426, PHNE_19937, and PHNE_20091, and provided a test system.

Switched BSDI test system from 2.1 and 3.1 to 4.0.1, courtesy of Terry Kennedy <terry@tmk.com>.

Added some more dev_t hacks for Alpha FreeBSD 4.0.

Added support for IPv6 on BSD 4.x. The support hasn't yet been tested, just compiled.

Added support for the mnt file system (mntfs or /etc/mnttab) on Solaris 8. Tested on Solaris 8 BETA-Refresh.

Made selection of optional fields (e.g., PPID with -FR) in a field output specification select the optional field, too, so that the option selector for the field (e.g., -R) isn't also required. This change was made in response to an inquiry from John DuBois <spcedt@armory.com>. This may require some revision to scripts that parse all field output; two scripts in the lsof distribution's scripts/ subdirectory had to be updated.

Corrected handling of Linux IPv4 addresses mapped in IPv6 addresses.

Tested under OpenBSD 2.6.

4.48 January 14, 2000

Modified -i argument processing of colon-separated IPv6 addresses to recognize an IPv4 address mapped in an IPv6 address and handle it as an IPv4 address. This was offered as a patch to 4.47.

Added a defined symbol (NOWARNBLKDEV) to control (inhibit) the issuance of a warning when no block devices are found. This was done anticipating its need in FreeBSD 4.x, but that dialect version no longer has any block devices, so HASBLKDEV was disabled for it instead. NOWARNBLKDEV was left in place for possible use in the future.

Enabled KAME IPv6 Configure support for FreeBSD when <netinet6/in6.h> is found.

Disabled use of gcc to compile lsof for 64 bit HP-UX 11.

Updated Configure to recognize FreeBSD 3.4.

Based on suggestions from Bernt Christandl

<beb@MPA-Garching.MPG.DE> improved AFS configuration for AIX and Solaris, and updated AIX AFS 3.5 support. Johannes Tax <tax@bluedog.oit.unc.edu>, Hung T. Pham <hung_pham@unc.edu>, and Curt Freeland <curt@grumpy.cse.nd.edu> provided test systems.

Updated lsof's private rnode definition for AIX 4.3.3, since IBM still doesn't ship the <oncpus/nfs/rnode.h> header file and the rnode structure definition in <nfs/rnode.h> doesn't match what the kernel uses. This was offered as a patch to 4.47.

Weakened the test in the Linux /proc-based lsof of the field count of data lines in /proc/net/{tcp,udp}. It appears that recent 2.3.x Linux kernels have added untitled fields to these files. The bug report came from Gabor Liptak <gaborliptak@usa.net>.

Adjusted for a FreeBSD 4.0 change in the definition of [_]KERNEL. David O'Brien <obrien@NUXI.com> reported the problem and provided a test system.

Removed the HASPPID bracket from fppid (the -R option state variable) so that the field select table will compile even when HASPPID is not defined. This problem was introduced at revision 4.47 with code that causes some field output characters to set option states. The problem was reported by David Bacon <bacon@birch.eecs.lehigh.edu>.

4.49 April 3, 2000

Made clearer in man page that "Lxx" FDs are AIX loader table references. Also updated the 00FAQ discussion of the Stale Segment ID bug to include AIX 4.3.x.

Modified support for NetBSD 1.4Q to include the <sys/buf.h> header file to cope with an MFS change.

Added support for OpenBSD UVM virtual memory.

Added support for AIX systems with > 2GB of memory. Chris Sylvain <csylvain@itg.ummc.umd.edu> reported the problem and provided the solution. Chris also supplied some minor code cleanup. This was offered as a patch to 4.48.

Based on new information from Igor Schein <igor@txc.com> made additional compensation in Configure script for 64 bit Solaris 7 and 8 gcc.

Added some 00FAQ info on the effect ordering of the +fg and -FG options has on output format.

Improved NetBSD IPv6 configuration, based on a suggestion from Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at>. Added code to convert IPv4-mapped-in-IPv6 addresses to IPv4 addresses.

Updated the information in 00FAQ and the HP-UX 11 binary directory README files on the HP-UX 11 ipis_s patch with new information supplied by Eric McWhorter <emcwhorter@xis.xerox.com>.

Added documentation on changes to HASFSTYPE and HASNCACHE, and the new HASPRIVPRIPP.

Adjusted Configure for FreeBSD 5.0. Made additional, necessary changes to Configure and the BSDI sources to eliminate load errors.

Added KAME IPv6 support to FreeBSD at the request of Ollivier Robert <roberto@eurocontrol.fr>, who provided a test system.

Corrected the script that generates the CHECKSUMS files for binaries to correctly name the detached PGP certificate. The documentation bug was reported by Michael Hennecke <hennecke@rz.uni-karlsruhe.de>.

4.50 June 29, 2000

Added a NetBSD alpha test host, courtesy of Ray Phillips <r.phillips@mailbox.uq.edu.au>. An lsof 4.49 binary, built on Ray's 1.4.1 system was made available prior to the 3.50 release.

Upgraded the system map file tests in /dev/kmem-based Linux lsof, making the use of DEBIAN_LINUX_LSOF unnecessary. Tested the changes on a system made available by Vincent Kujala <kujala@geog.ubc.ca> and Jim Mintha <jim@ic.uva.nl>.

Forced AIX to use the large-file-enabled versions of lstat (lstat64) and stat (stat64) if <sys/stat.h>

contains stat64. This should allow lsof to stat() AIX files > 2GB even when the builder has not defined the "large file enabled programming environment." Configure tests <sys/stat.h> and puts -DHASSTAT64 in the Makefile's CFLAGS to make this happen. Fernando A.B. Whitaker <whitaker@cenapad.unicamp.br> reported the problem. This was offered as a patch to 4.48.

Enabled Configure script to handle OpenBSD 2.7. Angelos D. Keromytis <angelos@dsl.cis.upenn.edu> reported the availability of OpenBSD 2.7 and supplied the Configure script patch.

Improved handling of DOOR and fattach()'d files in Solaris.

Changed message about missing kernel symbol file from "not yet determined" to "none found".

Updated FreeBSD, NetBSD, NEXTSTEP, OpenBSD, and OPENSTEP support to report "no PCB" and the values of the SO_CANTSENDMORE and SO_CANTRCVMORE state flags when a socket structure has no inpcb pointer. This modification was made to AIX lsof at revision 4.46. Added an entry to 00FAQ about sockets that have no inpcb pointer.

Upgraded support for FreeBSD 5.0-CURRENT. Ben Smithurst <ben@scientia.demon.co.uk> supplied patches and did testing. David O'Brien <obrien@NUXI.com> supplied a test system. The update included dropping the FcTTY part of file descriptor file system support, conditional on a Configure script test. I propagated those changes to BSDI, NetBSD, and OpenBSD in anticipation of their having the modification in the future. David also arranged with Michael Haro <mharo@area51.fremont.ca.us> for a FreeBSD 3.4 test system.

In response to an lsof 3.72 bug report from Jim Mewes <jim@corp.phone.com>, added more kernel address filtering to the lsof function, kread(), that reads Solaris kernel data.

In response to a report from Marc Duponcheel <marc@offline.be>, added tests to the /proc-based Linux lsof to ignore file systems of types "autofs"

and "pipfs".

Based on a report and information supplied by Casper Dik <casper@holland.Sun.COM>, updated the ncache_load() function in lib/rnch.c with new code that deals with a post Solaris 8 change in kernel name cache (DNLC) handling. Casper tested the update, which should be invisible to Solaris versions without the new DNLC code.

Added support for Solaris VxFS QIO files, based on a report from Kieran Broadfoot <kieran.broadfoot@gs.com>. Kieran help test the support.

Added support for PTX 4.4.6 and 4.5[.1] with help from the usual cast of good people at Sequent.

Added support for 64 bit file sizes and offsets on BSDI, FreeBSD, NetBSD, and OpenBSD, based on a report from Dan Nelson <dnelson@emsphone.com>. Dan supplied a patch and did FreeBSD testing.

Added Configure script recognition of NetBSD 1.5, based on a report from Andrew Brown <atatat@atadot.net>. Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at> updated the NetBSD port package to use a pre-release of this addition.

At the last minute saw a notice via deja.com's UseNet search service that FreeBSD 3.5 had been released and lsof didn't grok it. Added recognition of 3.5 to lsof's Configure script, but didn't have the opportunity to test lsof on 3.5.

4.51 August 21, 2000

Added Configure script support for the upcoming Solaris 9 release based on suggestions from Casper Dik <Casper.Dik@holland.sun.com>.

Changed sample Perl scripts to assume that /usr/local/bin/perl is Perl 5 and Perl 4 may be found in /usr/local/bin/perl4.

Updated Configure to recognize FreeBSD 4.1 and made a FreeBSD pre-release distribution available.

Bela Lubkin <belal@sco.COM> tested lsof on the upcoming SCO OSR 5.0.6 release and reports that

lsof appears to work properly.

Updated the AIX compiler test in Configure to recognize its version 5.

Updated AIX 4.3.3 support with automatic recognition of the proper rnode structure, based on machine bit width. Also added code to detect when processing the -X option that lsof has been compiled with the "other" AIX 4.3.3 user structure and to apply compensations. When a compensation method works, it's applied during subsequent -X processing; when none works, further -X processing is disabled.

Added Tru64 UNIX 5.1 support. Updated Tru64 UNIX library text file support to recognize new kernel support for AdvFS library files. Berkley Shands <berkley@cs.wustl.edu> and Klaus Saggerer USG [saggerer@zk3.dec.com] helped put me in contact with Chang Song <song@zk3.dec.com>, the developer of 5.1's new kernel name cache and he helped me develop new code in lsof to access it.

Corrected reporting of PTX fattach()'d address.

Changed Configure and dlsof.h for NetBSD and OpenBSD to use /usr/include/uvm header files when available. Andrew Brown <atatat@atatdot.net>, Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at>, and Wolfgang Rupprecht <wolfgang@wsrcc.com> pointed out the need to do this for NetBSD. Andrew provided access to a NetBSD 1.5 system for verifying the changes.

Installed snprintf() support, including a private version in the lsof library for those UNIX dialects without the function. Changed all sources to use it instead of sprintf() and strcpy().

Fixed a memory leak in the readvfs() functions of BSDI, DEC/OSF1, Digital UNIX, FreeBSD, NetBSD, OpenBSD, and Tru64 UNIX.

Tested on Linux 2.4.

Modified the Pyramid MkKernOpts script to compensate for `uname -s` configuration alternatives. Robert Dahlem <Robert.Dahlem@ffm2.siemens.de> supplied the modification.

Obtained access to an FCS Solaris 8 64 bit system and built lsof on it, using Sun Workshop C 5.0 and gcc 2.96 20000814 (experimental). Both compilers produce a working lsof.

4.52 November 8, 2000

Completed work on an HP-UX 11.11 port that uses a pstat(2) interface provided by HP. To distinguish it from its predecessors for HP-UX, this lsof version is called PSTAT-based and the predecessor versions are now called /dev/kmem-based. I am indebted to the far-sightedness and support of these good people at HP for making PSTAT-based lsof possible: Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. The PSTAT-based sources are in lsof_4.52/dialects/hpux/pstat, the /dev/kmem-based ones in lsof_4.52/dialects/hpux/kmem.

Ported to IBM Monterey for Merced/Itanium, aka AIX 5L. It configures via the Configure script's "aix" abbreviation and has been tested on AIX 5L Beta 3. Jay Beck, Steve Dibbell, Loc Le, Nasser Momtaheni, and Malcom Zung of IBM provided generous support. Since AIX 5L is still in Beta testing, this port can't be considered complete.

Added Configure support for OpenBSD 2.8. David Mazieres <dm@cs.nyu.edu> provided a test system.

Based on a report from Marc Christensen <marc@mecworks.com> added sockfs to the mount scan exemption list for /proc-based Linux lsof.

Added large file, CDFS, and DOSFS for UnixWare 7.x. Added UnixWare device memory mapping support. All UnixWare changes were supplied by Eric Dumazet <edumazet@cosmosbay.com> Eric also supplied some miscellaneous bug fixes.

Deferred name cache loading until printname() needs to use the name cache.

Terminated Pyramid, SunOS 4.1.x, and Ultrix support, because test systems are no longer available. Final Pyramid and Ultrix source code distributions for lsof revision 4.51 may be found on lsof.itap.purdue.edu

in pub/tools/unix/Isos/OLD/src. The no longer supported SunOS 4.1.x source code is still distributed with the Solaris source code.

Added code to set Solaris node address to real vnode address, when applicable.

John Speno <speno@lopan.isc-net.upenn.edu> provided information that enabled me to update the Tru64 AdvFS (MSFS) node definition for AdvFS version 5.

Added Tru64 5.x CFS support with help from Kris Chandrasekhar <Kris.Chandrasekhar@compaq.com>, Diane Lebel <lebel@zk3.dec.com>, and John Speno. The support only provides information about cached file attributes.

Installed a Configure patch for HP-UX 11 supplied by Kenneth Stailey <kstailey@disclosure.com> that adds another command to q4 input.

Tested on FreeBSD 4.2.

Will Day <willday@rom.oit.gatech.edu> and Frank Winkler <frank.winkler@germany.sun.com> graciously supplied Solaris 8 binaries.

Added Solaris 9 text file support, supplied by Casper Dik <Casper.Dik@holland.sun.com>.

4.53 December 6, 2000

Added the AIX 5L j2_lock.h to the distribution with a Configure script step to use it when it's missing from /usr/include/j2.

Removed SunOS 4.1.x support.

Removed Linux 2.0.x /dev/kmem support.

Fixed VBLK and VCHR special device file reporting to handle /dev information more accurately.

Added a Apple Darwin / Mac OS X 1.2 port, provided by Allan Nathanson <ajn@apple.com>. Allan also arranged for a test system so I can maintain this port. An additional test system was provided by Dale Talcott.

Dropped claims of support for all UnixWare versions except 7.1.0, since that is the only version on which I can test lsof. Even though lsof 4.53 is deprecated for UnixWare 2.1.3, installed a patch for it with testing done by A. Channing Clark <clark.channing@heb.com>.

Dropped claims of support for all SCO OpenServer versions except 5.0.5, since that is the only version on which I can test lsof.

4.54 January 19, 2001

Added compensation for a change that made the FreeBSD mount structure invisible. I can only test back to 3.2 and the compensation works there, so it's been #ifdef'd for 3.2 and above. David O'Brien <obrien@FreeBSD.org> provided the necessary clue.

Based on a report from Valdis Kletnieks <Valdis.Kletnieks@vt.edu>, changed all IPv6 support to report a TYPE of IPv6 for sockets with IPv4 addresses mapped in IPv6 addresses. The previous lsof behavior was to report their TYPE as IPv4.

Restored the Linux Glibc test to Configure, removed at revision 4.53, based on a report from John Dzubera <zube@cs.colostate.edu>, that RedHat Linux 6.0 still needs the test.

Made setting of link count for Solaris more selective.

Limited Readlink() recursion to MAXSYMLINKS. The bug was reported by Jan Dvorak <johnydog@go.cz>.

Dropped the *claim* that lsof runs on Solaris 2.5.1. It may well do so, but I no longer have access to a test system.

Fixed an #endif comment typo, reported by Igor Schein.

Fixed a typo in a cast for a Tru64 UNIX 5.1 function and updated Configure for Tru64 UNIX 5.0 and 5.1 with information from Jesse Perry <jesse.perry@compaq.com>.

Corrected non-fatal typos in the AdvFS support in dnode.c for Tru64 UNIX.

Added msdos file system support for NetBSD and OpenBSD.

Andrew Brown <atatat@atadot.net> requested and helped test it.

4.55 February 15, 2001

Based on a report from Bernd Eckenfels <eck@lina.inka.de> added support in lsof for files in /proc/<PID>/maps that have been deleted.

Changed PGRP output title to PGID, conforming to the most common current abbreviation for Process Group ID (PGID). While some systems continue to use *pgrp for internal kernel variable names, most systems that support the display of PGID via ps(1) now title it PGID. The lsof -g and -fg options operations are unchanged in function; only titles and descriptions have changed. Also changed internal variable names from *PGRP and *pgrp to *PGID and *pgid where possible.

Dropped the *claim* that lsof runs on HP-UX 9.x. It may well do so, but I no longer have access to a test system.

In response to a suggestion from Jeff Howie <jeff.howie@federated.ca> added support for command name selection by regular expression. A new form of the -c option value is used to identify and specify a regular expression.

Restore the *claim* that lsof works on UnixWare 7.0, since I re-acquired a test system.

4.56 May 3, 2001

Corrected some problems Amir Katz <Amir_Katz@bmc.com> found with Insure++, one in lib/dvch.c, the rest in Solaris sources. Amir's report also helped me find an error in an snpf() call that caused (the unsupported) Solaris 2.5.1 lsof to crash. Wally Winzer, Jr. <wally.winzer@ChampUSA.COM> helped test.

Added support for UnixWare 7.1.1 and above in-kernel UNIX sockets. John Hughes <john@Calva.COM> kindly provided code and access to a test system. John also provided a test system and advice for adding UnixWare 7.1.1 NonStop Cluster and CFS support. More help with that effort came from Kurt Gollhardt (SCO), Barbara Howe (SCO), Bela Lubkin (SCO), and Dewan Rashid <Dewan.Rashid@ir.com>.

Archived a set of compilation hints (patches) from Bill Melvin <Bill.Melvin@esc.edu> that make it possible to compile the old, unsupported lsof 3.08 sources on UnixWare 1.x without NFS or CDFS support.

Installed support supplied by Allan Nathanson <ajn@apple.com> for the Darwin "Gold Master" release, Mac OS X 10.0 (aka Darwin 1.3 in its public source version). Added Allan's CVS repository suggestions to the script that gets additional header files from an open source repository.

Tested an HP-UX 11.11 kernel patch from Sailu Yallapragada that enables reporting of TCP/IP information for telnetd processes that use the telnet multiplexor. I don't yet know the kernel patch ID.

Made the Solaris inclusion of <inet/mi.h> conditional on the Solaris version. (It's apparently not needed at 2.6 and above.) Bill Watson <bill.watson@uk.sun.com> brought this to my attention.

Added alternate Linux 2.4.x lock extent test, supplied by Jim Mintha <jim@ic.uva.nl>.

Rearranged the lines and pre-processor tests in regex.h, lib/regex.c, and lib/snprintf.c so that undef can be used to eliminate copyright and GPL statements when the files aren't being used for a particular dialect. (USE_LIB_* definitions in a dialect's machine.h header file determine if one or more of those three files are to be used.)

Added preliminary support for Solaris 8 with VxFS 3.4. This support will be refined as I get information from Veritas about how they will distribute the kernel header files lsof needs. Those header files were omitted from the standard VxFS 3.4 distribution. Technical assistance and testing were provided by Calle Dybedahl <cdy@algonet.se>, Gary Millen <gary.millen@veritas.com>, Rainer Orth <ro@TechFak.Uni-Bielefeld.DE>, Peter C. Vernam <pvernam@draper.com>, and Donna Yobs <Donna.Yobs@veritas.com>

Tested on FreeBSD 4.3-STABLE.

Dropped the *claim* that lsof works on UNIX dialects where I no longer have test systems: BSDI 2.1, 3.[01] and 4.0; DEC OSF/1, Digital UNIX and True 64 UNIX 2.0 and 3.2; FreeBSD 2.1.[67], 2.2[.x], 3.[012345] and 4.[01]; HP-UX 10.20; NetBSD 1.[234]; SCO OpenServer 5.0.5; and SCO UnixWare 7.0

Tested on Solaris 9 BETA, s81_36.

4.57 July 19, 2001

Help (-h) and version (-v) output now have URLs for the newly created and timeliest lsof FAQ (00FAQ in the lsof distribution) at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

and the man page for the current lsof distribution at:

ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man

Based on a report from Steve Laubscher <slaubs@woodward.com>, modified dlsof.h for PTX 4.6[.1] to avoid a temporary dnlc_t definition needed at PTX 4.5.1.

Corrected test for old Linux kernels in Configure. Henri Karrenbeld <ishtar@cal044202.student.utwente.nl> brought the error to my attention. Limited Linux claims to 2.1.72 and above in the documentation.

Improved HP-UX 11 Configure stanza and stream socket handling.

Constructed a work-around for the HP-UX 11 optional OnlineJFS package. The work-around sadly requires lsof to have a private version of the vx_inode structure, since the OnlineJFS package doesn't update <sys/fs/vx_inode.h>. Troyan Krastev <Troyan.Krastev@ricoh-usa.com> brought the bug to my attention and Michael Bracewell <michael@ra.TSS.PeachNet.EDU> provided a test system where I developed the work-around.

Added locale support to lsof's isprint() test, based on a suggestion from Dan Mercer <damercer@mmm.com>. Lsof will use setlocale(), when that function and

its supporting <locale.h> header file are available.

Added OpenBSD 2.9 support.

Based on a report from Aaron Rhodes <arhodes@psionic.com> and with testing help from Aaron, made the lsof 4.56 revision compile and work on OpenBSD 2.6. While that OpenBSD version is no longer supported, Aaron's report exposed a Configure script bug affecting OpenBSD versions lsof does support.

Updated for FreeBSD 5.0-CURRENT. Szilveszter Adam <sziszi@petra.hos.u-szeged.hu> help test. The lsof FreeBSD ports packager, David O'Brien <obrien@FreeBSD.org>, assisted.

Tested on AIX 5.1. Loc Le and Nasser Momtaheni of IBM provided test systems.

4.58 September 13, 2001

Added options to safestrprt() and safestrprtn() to surround the string with "" and to suppress the printing of an ending '\n'. Use of these functions in device cache file error message reporting answers a suggestion for better error reporting from John Jackson <jrj@purdue.edu>.

Fixed a Solaris 2.6 and above problem related to searching for "large" (O_LARGEFILE) files by name; lsof was using the wrong version of [l]stat(2). The bug was reported by Daniel Trinkle <trinkle@cs.purdue.edu>.

Added AIX 4.1.4 and above XTI socket support.

Added OSR Xenix Shared Data and Semaphore file type support with modifications supplied by Bela Lubkin.

Updated OPENSTEP support with modifications from Carl E. Lindberg <lindberg@clindberg.org>. The changes enable the correct reporting of executable and library open files ("txt" type).

Limited claims of OpenServer support to the versions where I currently test, 5.0.4 and 5.0.6. (Lsof probably works on 5.0.5.)

Enabled processing of -C option for PSTAT-based HP-UX

Isof.

Enabled and tested on FreeBSD 4.4.

Corrected a file system test example in 00QUICKSTART, based on a report from Jun Biao WANG <wangjunb@cn.ibm.com>.

Made available for re-distribution a user-contributed port of Isof 4.51 to Reliant UNIX 5.45. Thomas Mauterer <Thomas.Mauterer@philosys.de> contributed the port.

4.59 October 20, 2001

With the closing of the Sequent Synergy Links Lab by IBM, terminated Isof support for PTX. The last tested PTX Isof revision, 4.58, is available on Isof.itap.purdue.edu in .../Isof/OLD/src.

Adjusted for FreeBSD 5.0-CURRENT NFS header file changes, based on a report from Jos Backus <josb@cncdsl.com>.

Corrected a bug in the way Linux Isof identifies the owner of a process. Lionel Cons <lionel.cons@cern.ch> reported the problem and tested the fix. Added code to avoid stat(2) calls on regular Linux files whenever possible. Lionel reported the need to do this (AFS files) and tested the new code.

Added new output field for raw device number in hex. The field is identified with 'r'. This field is NOT selected when -F or -F0 is specified so that its appearance won't disturb existing scripts that process field output.

Added support for OpenUNIX 8. A test system was provided by Larry Rosenman <ler@lerctr.org>. Matthew Thurmaier <matt@compclass.com> and many people from Caldera provided technical assistance.

Added an additional UVM test to the NetBSD Configure stanza. Andrew Brown <atatat@atatdot.net> supplied the test; it recognizes NetBSD 1.5Y UVM changes to the vnode structure recently committed by Chuck Silvers.

Applied Configure and get-xnu-headers.sh script changes supplied by Allan Nathanson <ajn@apple.com>

for Darwin 1.4.

Added for Bela Lubkin <belal@mammoth.ca.caldera.com>
OSR-specific environment variables to supply values
to the Configure script. The variables are described
in 00XCONFIG.

Added an IP version selector to the -i option
parameters.

4.60 November 9, 2001

Added special handling to and corrected bugs in
the matching of IPv4 in IPv6 addresses to -i6:<...>
selectors.

Made 00FAQ corrections and updates, based on
discussions with Igor Schein <igor@txc.com>.

Modified Configure script to detect a 64 bit capable
gcc compiler and permit it to be used to build 64
bit (PA-RISC 2) lsof for HP-UX 11.00. Tested with
HP's gcc package, which Rich Rauenzahn of HP kindly
installed on a test system at HP. Stefan Marquardt
<stefan.marquardt@hagebau.de> helped test.

Made lsof's method of killing its child process
more robust, based on a suggestion from Bela Lubkin
<belal@caldera.com>.

Modified all dialect Makefile segments to accept
select -v #define's from the environment -- a
builder's comment, host, logname, system information
and user name. This was done for Bela Lubkin, so
he can "tune" the -v output when he packages lsof
in the upcoming Caldera OSR 5.0.7 release.

Changed Perl scripts in scripts/ to put the lsof
path consistently in \$LSOF. Also added a fix from
Bela Lubkin to scripts/big_brother.perl5 that allows
it to tolerate SCO OSR "ago" clauses in open UDP
file information. Strengthened emphasis in
scripts/00README that the scripts are examples that
shouldn't be expected to run on all UNIX dialects
without modification.

At Bela Lubkin's suggestion changed the device
cache file format examples in 00DCACHE and 00FAQ
to avoid "%U%". That's an SCCS escape sequence.

Added support for OpenBSD 3.0.

Added +DAportable to CFLAGS for 32 bit HP-UX 11.

Amir Katz <Amir_Katz@bmc.com> suggested the addition.

4.61 January 22, 2002

Updated field output example Perl scripts in the scripts/ subdirectory to discover the lsof path, starting at .. and proceeding through the PATH environment variable's directories.

Added minor OSR Configure script fixes, provided by Bela Lubkin <belal@caldera.com>.

In response to a report from Joshua Wright <Joshua.Wright@jwu.edu> modified NetBSD and OpenBSD Configure stanzas and sources so that lsof can be built when there is no system source tree (e.g., /usr/src/sys).

In response to a report from Peter Valchev <pvalchev@openbsd.org> improved the UVM test in the OpenBSD Configure stanza.

Updated Configure script to recognize FreeBSD 4.5.
Updated for FreeBSD 5.0 procs and pseudofs changes.

Updated HP-UX stanza to see if the compiler named in the LSOF_CC environment variable is the bundled compiler. If it is, "-O" is omitted from the compiler flags.

Updated Digital UNIX 4.x and Tru64 UNIX error message related to kernel name list failures. Added an FAQ section about how a kloadsv daemon failure can cause knlist(3) to fail. The condition was reported by Douglas B. Jones <douglas@gpc.peachnet.edu>

Based on a report from Mark W. Eichin <eichin@thok.org> made Linux lsof capable of handling and reporting file sizes greater than 32 bits.

Tested on Solaris 9 BETA-Refresh.

Corrected a bug in the matching of IPv4 addresses, mapped in IPv6 addresses, to an IPv4 parameter to an -i option.

Ported to 64 bit Power AIX 5.1 kernel with advice from David Clissold <cliss@austin.ibm.com> and Marc Stephenson <marc@austin.ibm.com>, and on a test system provided by Loc Le <lple@us.ibm.com>.

4.62 March 7, 2002

Updated 00README to reflect the usefulness of gcc for building AIX lsof. Documented a report from Brian L. Gentry <BGentry@nationsrent.com> of success on AIX 4.3.3. I documented my success on 32 bit Power AIX 5.1 and my lack of success on ia64 AIX 5.1 and 64 bit Power AIX 5.1.

Improved UnixWare >=7.1.1 reporting of UNIX socket NAME field information for NonStop Cluster systems with a patch provided by John Hughes <john@Calva.COM>. Offered John's improvement as a patch to lsof 4.61.

Corrected bugs in handling of open files on block devices by OSR lsof. The bugs were reported by Bela Lubkin <filbo@deephought.armory.com>.

Fixed bug in writing >32 bit device numbers for block devices to the device cache file.

Added support for reporting block special nodes not in /dev (or /devices). That required "like device special" be changed to "like block special" and "like character special". (00FAQ was updated.)

Based on a report from Peter Valchev <pvalchev@openbsd.org> improved the definition of the source for NetBSD and OpenBSD kernel symbols (the nlist() source file). NetBSD now defaults to getbootfile(3) if it is available, /netbsd otherwise. OpenBSD now defaults to /dev/ksyms if it is available, /bsd otherwise.

Made possible compilation under BSD/OS (BSDI) 5.0 with changes to Configure, dialects/bsdi/dlsof, dialects/bsdi/dproc.c and lib/rnmh.c. The changes were suggested by Steven Hinkle <hinkle@bsdi.com>. Note that these changes do not substantiate a claim that lsof works on BSDI 5.0, because I haven't tested it there.

Updated OpenUNIX private <sys/fs/memfs_mnode.h>.

based on a report from Larry Rosenman <ler@lerctr.org> that it had been updated by Caldera patch OU800PK3. Unfortunately the patch only corrects some of the problems with the header file, so it is still necessary to distribute a private patched version of it with the lsof sources.

Applied a man page correction reported by Frederic Delanoy <max_ok@yahoo.com>.

Corrected cast bugs related to using the HP-UX bundled C compiler on HP-UX 11.11.

4.63 April 23, 2002

Added HPUX_BOOTFILE environment variable for use by the Configure script in determining HP-UX kernel configuration information -- e.g., the state of the ipis_s structure in the HP-UX 11 kernel. The change was suggested by Marc Bejarano <beej@alum.mit.edu>. Marc also suggested some changes to the HP-UX section in 00FAQ that discusses Configure's use of q4 for HP-UX 11.

Fixed a bug in the Solaris lsof file system matching code. It was not reporting that VCHR files in /devices were in / when /devices was in /, too.

Corrected bugs in device number, file size, file offset, and raw device number field output generation.

Added recognition of OpenBSD 3.1 to the Configure script with a suggestion from Peter Valchev <pvalchev@sightly.net>. Note that this change does not constitute a claim that lsof works on OpenBSD 3.1, because I haven't tested it there.

Built an automated test suite. (See 00TEST and the tests/ sub-directory of the lsof main directory). Bela Lubkin requested it. Dale Talcott, John Hughes, and Larry Rosenman helped me validate it on their systems.

During the development of the test suite I discovered the following lsof bugs or missing features, and corrected or supplied them.

* Corrected the reporting of locks for:
o Digital UNIX 4.0d and Tru64 Unix 5.[01];

- o HP-UX 10.30 and 11.00;
- o OpenUNIX 8;
- o UnixWare 7.1.1.

* Enabled HP-UX 10.30 and 11.00 to report open NFS file link counts.

* Corrected the reporting of UNIX domain socket names for Apple Darwin, FreeBSD 4.5 and above, NetBSD 1.4.1 and above, and for OpenBSD 3.0 and above.

* Enabled HP-UX 11.11 to stat(2) large files.

* Fixed handling of combination 32 and 64 bit device numbers in AIX 64 bit architectures.

Updated the AIX 4.3.3 NFS rnode recognition code, first installed at revision 4.51. It looks like some IBM update has restored a single rnode structure independent of the machine bit width.

Updated the NetBSD and OpenBSD sources so NetBSD can process DTYPE_PIPE files, as OpenBSD was already able to do.

Updated Darwin get-xnu-headers.sh script to reflect information about a recent reorganization of the Darwin CVS hierarchy, supplied by Allan Nathanson <aj@apple.com>.

Added defense against the standard I/O descriptor attack.

4.64 June 26, 2002

Corrected some FreeBSD pre-processor directives.

David O'Brien <obrien@NUXI.com> pointed them out.

Updated lsof's main() function to: 1) close all open file descriptors above 2 before starting; and 2) to set a non-interfering umask. Moved GET_MAX_FD test from misc.c to proto.h, so that main() could use it. Added multiple-include protection to proto.h.

Moved FAQ's test suite Q's & A's to a more appropriate section. Added a Q&A on HASSECURITY option and its affect on searching for open files. (That was

already in the man page.)

Updated hpux/kmem/dnode.c for HP-UX < 11 compilation with information from John Dzuberka <Zube@CS.ColoState.EDU>. While lsof doesn't support HP-UX < 11 any more, I try to avoid disabling it there when possible, and a locking fix for HP-UX >= 11 in lsof 4.63 inadvertently disabled compilation of lsof for HP-UX < 11. Fixed long-standing bug in HP-UX 10.20 lock reporting.

Removed language from the test suite programs that requires an ANSI-C compiler. This allowed the test suite to be validated with cc and gcc on the unsupported HP-UX 10.20.

At the suggestion of Manuel Bouyer <bouyer@antioche.eu.org> switched NetBSD and OpenBSD lsof from using nlist() to using kvm_nlist(). Made the same change for BSDI, Darwin, and FreeBSD.

Validated test suite on OPENSTEP 4.2.

In response to a suggestion from Jeff Stoner <jstoner@blackboard.com> enhanced support for the FD list of the -d option to allow it to be either an exclusion or inclusion list, using the '^' prefix to denote exclusions.

Made adjustments for FreeBSD 4.6 and 5.0-CURRENT. Fixed a FreeBSD /etc/make.conf CFLAGS extraction bug, reported by Kris Kennaway <kris@obsecuity.org>, and new a bug in the fix, reported by Eric Cronin <ecronin@eecs.umich.edu>

Added nullfs support for FreeBSD, NetBSD, and OpenBSD at the request of Andrew Brown <atatat@atatdot.net>.

Modified all readmnt() functions to ignore mounted-on directory names that don't begin with '/'.

Tested on NetBSD 1.6A and OpenBSD 3.1.

Upgraded to Solaris 9 FCS with two changes to the BETA-Refresh support: 1) an adjustment to dnode.c for a change in the so_so (sonode) structure; and 2) addition of Solaris 9 FCS specific DNLC code. David Comay <David.Comay@Eng.Sun.COM> sent me the

dnodc.c change and Casper Dik <Casper.Dik@sun.com>
helped with the new DNLC support code.

Applied OpenUNIX changes that permit lsof to compile
and run on the upcoming 8.0.1 release. The changes
were supplied by Robert Lipe <robertl@caldera.com>.
Larry Rosenman <ler@lerctr.org> provided a test
system.

Added Solaris fd file system support.

4.65 October 10, 2002

Adjusted for change in FreeBSD 5.0-CURRENT inode
structure, reported by David O'Brien <obrien@NUXI.com>.
Adjusted for changes in FreeBSD 5.0-CURRENT <sys/vnode.h>.
One change was reported by Anders Nordby
<anders@FreeBSD.org>. Adjusted for FreeBSD 5.0-CURRENT
on sparc64 architecture.

Enhanced the error reporting of Solaris lsof when
it detects a kvm_open() failure, and added a 00FAQ
entry on the cause, based on a report from Peter
J. Bertocini <pjb@anl.gov>.

Enabled compiling of lsof for NetBSD 1.5 with the
NULL file system, using a patch from Andrew Brown
<atatat@atatdot.net>.

Removed a hack in the LTbigf test program that was
once needed when it was compiled on Solaris 9 BETA-
Refresh with gcc. The hack isn't needed on Solaris
9 FCS. Janet Hempstead <jan@library.carleton.ca>
brought the need for this change to my attention.

Applied a patch, supplied by Andrew Brown
<atatat@atatdot.net>, that updates lsof for NetBSD
version 1.6F. Corrected handling of the NetBSD
nullfs.

Updated to BSDI BSD/OS 4.3 on a test system kindly
provided by Terry Kennedy <terry@tmk.com>.

Updated to FreeBSD 4.7.

Updated to Apple Darwin 1.5, 5.x and 6.x with
patches supplied by Allan Nathanson <ajn@apple.com>.
The patches include IPv6 support.

Updated Configure to use the -bnolibpath loader option when building lsof on a PowerPC, running AIX 5 or greater. Valdis Kletnieks <Valdis.Kletnieks@vt.edu> informed me this was needed. Lsof for AIX 5.x was initially developed on the IA64, where -bnolibpath can't be used and I didn't think to restore it to PowerPC loads when AIX 5.x became available for that architecture.

Updated to UnixWare 7.1.3 on a test system provided by Larry Rosenman <ler@lerctr.org>. Removed claims that lsof works on OpenUNIX 8.0.1, because UnixWare 7.1.3 is the release name of OpenUNIX 8.0.1.

Based on a comment that his e-mail address was wrong in the lsof distribution from Kenneth Stailey <kstailey@disclosure.com>, removed all e-mail addresses from lsof documentation files except this one, 00DIST. The addresses in 00DIST are used to send revision release notices to those who contributed to a revision, but the addresses in this file for previous revisions and in other documentation files sometimes grow stale and are never validated.

4.66 December 22, 2002

Acquired Solaris 7 and 8 test systems, courtesy of John Dzuberka <Zube@CS.ColoState.EDU>. Updated 00TEST and tests/TestDB accordingly.

Clarified FreeBSD 5.0 architecture claims at the suggestion of David O'Brien <obrien@NUXI.com>. Also implemented David's suggestion to change Intel to x86.

Installed changes to DNLC handling in OSR lsof in preparation for handling changes in the OSR 5.0.7 DNLC cache. Information about the changes and patches to handle them were supplied by Bela Lubkin <filbo@deephought.armory.com>.

Upgraded True 64 UNIX support to the 5.1B release on a test system provided by Berkley Shands <berkley@cse.wustl.edu> Had to use relaxed ANSI compilation because of an error in a system header file and other lsof source usages.

Implemented the HASNOSOCKSECURITY compile-time option. When it and HASSECURITY are defined, lsof

will be built to list only the user's open files, but will also list anyone else's open socket files, provided the "-i" option selects their listing. Updated the Customize script to ask about setting HASNOSOCKSECURITY. Left it undefined in all dialect machine.h header files. This change was requested by Kenneth Stailey <kstailey@speakeasy.net> for use with ntop.

Added support for OpenBSD 3.2 and its kernel trace file.

Improved lsof help (-h) and version (-v) information reporting.

Fixed a FreeBSD 4.7 and above off-by-two UNIX domain socket path termination bug, reported by Ken Stailey <kstailey@speakeasy.net>

4.67 March 27, 2003

Began the transition of the lsof ftp server host name from vic.cc.purdue.edu to lsof.itap.purdue.edu. That reflects Purdue organizational changes. This first step makes the new name an alias to the old one. The old name, vic.cc.purdue.edu, will remain usable for an extended period.

Corrected a revision number reference in section 17.17 of 00FAQ on the appearance of Solaris negative DNLC caching handling.

Updated 00FAQ discussion of compilers for 64 bit Solaris.

Validated test suite for 64 bit Solaris 8 and gcc.

At the request of Alek O. Komarnitsky <alek@komar.org> added the "+c <width>" option to enable optional changing of the COMMAND column output maximum width from the default to <width>. The default maximum width remains CMDL, as defined in lsof.h.

Fixed three AIX kernel bit size detection bugs, one in the AIX Configure script stanza, the second and third in the AIX dproc.c get_kernel_access() function. The bugs were reported by Pierre-Yves Fontaniere <pyf@cc.in2p3.fr>, who tested the fixes.

Added kernel event queue file support for FreeBSD, NetBSD and OpenBSD. Andrew Brown <atatat@atadot.net> supplied the code.

Updated to AIX 5.2 on a test system provided by Dale Talcott <dtalcott@purdue.edu>. Had to build work-arounds for two missing AIX 5.2 header files, <j2/j2_snapshot> and <proc/proc_public.h>. Corrected an off-by-one UNIX socket addressing bug. Taught AIX lsof to handle both jfs and jfs2 files at the same time. Adjusted for an IBM mistake in the sizing of the fdsinfo structure in <procinfo.h> Toshiya Nakamura <TOSHIYAN@jp.ibm.com> helped test,

Updated to FreeBSD 4.8. Corrected another bug in FreeBSD UNIX domain socket name handling.

Corrected gcc build problems on HP-UX 11i, reported by Yuliy Minchev <yuliy@mobitel.bg>.

Updated BSDI BSD/OS support to 4.3.1.

Augmented a lock ID test on NetBSD to check if the ID is an LWP pointer.

4.68 June 18, 2003

Enhanced Configure script's cleanup operations.

Added support for OpenBSD 3.3, based on a report from Peter Valchev <pvalchev@sightly.net>.

Improved the description of the detached PGP signature certificate file in the main lsof README file, based on a suggestion from Diana Stockdale <diana@mpl.ucsd.edu>.

Installed a work-around for FreeBSD 5.0-CURRENT on Alpha to avoid a compiler register use complaint.

Corrected a 'c' option error message. Gnele <blaadeleng@yahoo.com> reported the problem.

Upgraded EXT2FS and UFS support for NetBSD and OpenBSD to handle new inode information, and the fast UFS1 and UFS2 file systems.

With the help of Andrew Brown <atatat@atadot.net> determined the NetBSD snapshot (1.6F) at which

<sys/mount.h> could be included under `_KERNEL`, thus eliminating the `lsof netexport.h` hack. The same change applies to OpenBSD versions 3.3 and above.

Applied a patch from Armin Gruner <ag@muc.de> that corrects the use of the `HASPROCFS` definition in the FreeBSD dialect sources.

Corrected spelling errors in `00FAQ` and in the generated `00.README.FIRST_<version>` file of the distribution archive. John Jackson <jrj@purdue.edu> and Ray Phillips <r.phillips@jkmrc.uq.edu.au> spotted and reported the errors.

Corrected a spelling error in a comment and incorrect use of an alarm function in the `LTsock` test program.

At the suggestion of Stuart Anderson <sba@srl.caltech.edu> added preliminary (and incomplete) SAM-FS file system support to Solaris `lsof`. Completion awaits availability of SAM-FS internals.

Fixed a Solaris device name printing bug, reported by Ric Anderson <ric@tick.Telcom.Arizona.EDU>, only visible when `HASDCACHE` is not defined. Ric helped test the fix.

Fixed an AIX kernel bit size handling bug related to the NFS node (`rnode`) structure.

Corrected a `print_kptr()` function call error in the AIX AFS code, reported by David Steiner <david.r.steiner@Dartmouth.EDU>. Upon further reflection and because I no longer have appropriate AIX AFS test systems, disabled AIX AFS support in the `Configure` script for AIX versions above 4.3.3.0 or AIX AFS versions above 3.5.

Added support for FreeBSD 5.1.

With advice from Allan Nathanson <ajn@apple.com> adjusted the Darwin `get-xnu-headers.sh` script to access the kernel header files needed by `lsof` from a new form of the Apple open source repository.

Installed Linux and `lsof` library bug fixes and improvements, supplied by Marian Jancar <mjancar@suse.cz>. One Linux improvement handles mount strings that have octal escapes in them, eg., `\040` for embedded

blanks. Marian tested the changes.

4.69 October 16, 2003

Received and applied an OpenBSD patch from Peter Valchev <pvalchev@sightly.net> that replaces a ctob() call with a sysconf() call. Peter claims sysconf() is needed for OpenBSD on SPARC. (It is not needed for NetBSD on SPARC.)

With the upgrade of my only Solaris 7 test system to, Solaris 8, dropped the *claim* that lsof works on Solaris 7. That doesn't mean it won't work there, so those who want lsof for Solaris 7 probably should be able to build it there and it probably will work there.

Revised lsof's DNLC handling for BSD derivatives, including: BSDI; Darwin, DEC OSF/1, Digital UNIX and Tru64 UNIX; FreeBSD; NetBSD; and OpenBSD. The latest NetBSD distribution's dropping of the vnode capability ID (v_id) required the revision.

Adjusted to the latest FreeBSD 5.1-CURRENT.

Added NetBSD support for using kvm_getproc2().

Added a patch from Andrew Brown <atatat@atadot.net> to handle NetBSD enum conflicts and changes in the <miscfs/kernfs/kernfs.h> and <miscfs/procfs/procfs.h> header files.

Added a "#define _KERNEL" to the AIX dnode2.c source file for compatibility with a new <j2/j2_inode.h> AIX 5.2 header file version. The addition was supplied by Dick Dunbar <Dick.Dunbar@Siebel.com> and was offered as a patch to lsof 4.68/

Added support for a second type of Solaris SAMFS. Stuart Anderson <sba@srl.caltech.edu> provided the support. SAMFS support in lsof SOLARIS remains scanty, because Sun won't release any details on its kernel structures.

Dropped the *claim* that lsof works on AIX 4.3.3, because I was unable to test it there. That doesn't mean it won't work there, so those who want lsof for AIX 4.3.3 probably should be able to build it there and it probably will work there.

Updated for Solaris 10 on test systems provided by Mike Miscevic <miscevic@hotpop.com>. Casper Dik <casper@holland.sun.com> provided significant help. During the Solaris 10 port found and fixed an lofs handling bug that prevented reporting of open lofs file lock status.

Updated the DNLC test, LTdnlc, to provide a possible explanation about file systems on which the test might fail.

Modified the procedure for obtaining missing Darwin XNU kernel header files. The new one requires more manual intervention, but is the best that can be done with the way Apple open sources are now organized. 00FAQ explains the new procedures for those not used to downloading Apple open source files.

Added support for Apple Darwin 7.0 (Mac OS X 10.3) with patches supplied by Allan Nathanson <ajn@apple.com>. Dropped the *claim* that lsof builds and works on Apple Darwin below 6.0.

Validated lsof on FreeBSD 4.9, using a test system provided by Ben Lewis <bl@purdue.edu>.

Validated lsof on FreeBSD 5.1-CURRENT for Amd64. David O'Brien <obrien@FreeBSD.org> provided a test system.

Changed the NetBSD Configure stanza to do header file searches in /usr/include by default. The LSOF_INCLUDE and NETBSD_SYS environment variables may still be used to specify other search paths. Discussions with Andrew Brown and Wolfgang S. Rupprecht <wolfgang@wsrcc.com> led to the change.

4.70 January 16, 2004

Improved shell-portability of the linux stanza of the Configure script with a patch from Paul Jarc <prj@po.cwru.edu>.

Added a "silent" rule to tests/Makefile for Paul. Updated, extended and clarified the test suite documentation in 00FAQ and 00TEST.

Fixed Solaris 10 dlsof.h typo, reported by Mike

Miscevic <miscovic@hotpop.com>. The typo prevents lsof from loading cleanly in Solaris 10 builds past 40.

Fixed a Solaris HSFS node number reporting bug and added a structure definition work-around for Solaris 10.

Converted PGP signing to GPG. My previous PGP key can be used, but the gpg "--allow-non-selfsigned-uid" option may have to be used when it is imported into a GPG key ring.

Added bz2 compression.

Updated for OpenBSD 3.4.

Added a work-around for a missing header file in the s10_44 Solaris 10 build.

Added support for FreeBSD 5.2-BETA and 5.2-CURRENT.

Updated Linux AX25 support with modifications supplied by Lutz Poetschulat <dl9cu@db0zwi.de>.

Added raw IPv6 support to Linux lsof.

Improved handling of parameters after "-i@".

Improved file name test in LTdnlc.c.

Added loop count controls to the reading of Solaris lock chains. The change was implemented as a result of a report from Steve Gonczi <steve@relicore.com>.

Based on a report from John Jackson <jrj@purdue.edu>, enabled a Solaris 10 <sys/lgrp.h> work-around for Solaris 9, too. (Patch 112233 installs an lgrp.h on Solaris 9 that needs the work-around.)

With help from Andrew Brown <atatat@atadot.net> and John Heasley <heas@netbsd.org> added log-structured file system (LFS) support for NetBSD and OpenBSD.

Added AMD64 to the list of FreeBSD 5.x-CURRENT supported architectures. FreeBSD.org provides a test system, courtesy of (I believe) David O'Brien <obrien@FreeBSD.org>.

Added a cast to lseek() in the HP-UX /dev/kmem-based kread() function to make it work properly with the bundled HP C compiler.

4.71 March 11, 2004

Added text file support to Apple Darwin lsof and enabled the lsof executable portion of the LTbasic test. Added support for Darwin kernel queue, POSIX semaphore and POSIX shared memory files. Tested on Darwin 7.2 (aka Mac OS 10.3.2).

Added process_kqueue() function prototypes for FreeBSD, NetBSD and OpenBSD.

Picked some lint in AIX sources, lib/rnmh.c and tests/LTsock.c.

Added "-x [fl]" cross-over option, which enables +d and +D processing to cross over symbolic links and/or file system mount points. Discussion with Johan Lindquist <johan@smilfinken.net> and Eric Williams (aka The Ghost In The Machine) <ewill3@earthlink.net> on Linux news groups revealed the need for the option.

Updated support for UnixWare 7.1.4.

Added support for the optional reporting of socket options, socket states and TCP flags for most currently supported dialects. John Smith <lbalbalba@hotmail.com> and Tristan Nefzger <tn@bhtrader.com> requested the information. The dialects and their versions for which this feature has become available include:

- AIX 4.3.2 and 5.[12]
- Apple Darwin 7.2
- BSDI BSD/OS 4.3.1
- Digital UNIX and Tru64 UNIX 4.0
- FreeBSD 4.9 and 5.2
- HP-UX 11 and 11.11 (aka 11i)
- NetBSD 1.6ZH
- OpenBSD 3.4
- OPENSTEP 4.2
- OpenUNIX 8
- SCO OpenServer Release 5.0.6
- Solaris 2.6, 8, 9 and 10
- UnixWare 7.1.[134]

Modified the Configure stanza for HP-UX 11 with better

q4 detection. Steve Bonds <3vhmxxm02@sneakemail.com> supplied the modification.

Applied a patch from Mike Miscevic <miscevic@hotpop.com> to enable lsof to compile with the zone support in the Solaris 10 s10_b51 release. Added information on lsof zone behavior to 00FAQ.

Added a "-z [z]" option to Solaris 10 lsof. It enables the listing of zone name and can also be used to select the listing of processes and their files from specified zones.

4.72 July 13, 2004

Corrected Solaris 10 ZONE column title display bug with a patch from Joep Vesseur <Joep.Vesseur@Sun.COM>. Joep's fix was offered as a patch to 4.71.

Based on a report from Jean-Pierre Radley <jpr@jpr.com> about an unexpected GNU uname Configure interaction on OSR, and working from information received from Bela Lubkin, changed the OSR Configure stanza to use /bin/uname instead of uname. Added an FAQ entry about Configure version detection problems.

Added the +m and "+m m" options in response to a dialog with Robert T. Brown <rbrown@netmentor.com>. The options allow the creation of a mount table supplement file which can be used on selected dialects to get device numbers when stat(2) and lstat(2) can't deliver them. (That's generally the result of an inaccessible NFS server.) Currently the new options are supported only on Linux.

Made cpumask_t typedef _KERNEL compensation for FreeBSD 5.2-CURRENT. Refined it for 5.2.1-RELEASE with testing help from Scott Ellentuch <tuc@tsg.com>.

Added support for FreeBSD 4.10. Larry Rosenmann <ler@lerctr.org> kindly provided a test system.

Added support for NetBSD 2.0 with patches supplied by Andrew Brown <atatat@atadot.net>. Andrew also provided two test systems.

Made handling of Linux maps file more robust, based on a report from Jan Blunck <J.Blunck@tu-harburg.de>. As a side benefit, made handling of generated stat(2)

information more flexible.

As a result of a discussion with Jason Fortezzo <fortezza@mechanicalism.net>, adjusted lsof for Solaris to obtain the maximum user name length from ut_name of the utmpx structure, if <utmpx.h> exists.

Tested under OpenBSD 3.5.

Updated README information about using gcc (via the Configure aixgcc abbreviation) to compile lsof on AIX. Ann Janssen <ajanssen@nebook.com> made me aware the information was out of date.

Added an AIX SIGDANGER handler and some FAQ sections on lsof memory usage after a discussion with Tom Qin <tom.qin@citigroup.com> about lsof memory usage.

Added scripts/sort_res.perl5, contributed by Fabian Frederick <fabian.frederick@gmx.fr>. The script displays lsof output sorted by size and path name.

Improved handling of files on Linux NFS mount points that use the root_squash option, based on discussions with Paul Szabo <psz@maths.usyd.edu.au>.

Updated FreeBSD 5.2-CURRENT support, based on a problem report from Filippo Natali <filippo@widestore.net>.

Corrected improper FreeBSD 5.x-CURRENT #if condition, reported by Kim Culhan <kimc@kim.net>.

Added a Configure script work-around for AIX 5.2 lsof with JFS2, compiled by gcc >= 3.3. The work-around was supplied by Florian M. Weps <fmw@hactrn.ch>.

4.73 October 21, 2004

Added an `__XPG4_CHAR_CLASS__` #define before #include'ing <ctype.h> on Solaris to restore lsof's ability to display special characters such as acute-e.

Added wide-character (e.g., UTF-8) support where possible, prompted by a request from Kyungjoon Lee <kjoonlee@gmail.com>. Some older dialects -- e.g., NetBSD 1.4.1 -- don't support wide characters, so the wide character support is enabled by definitions in each dialect's machine.h. Dialects with wide-character support are listed in FAQ.

Make a FreeBSD 5.2-CURRENT adjustment for <sys/pipe.h>, supplied by Sergey A. Osokin <osa@FreeBSD.ORG>.

Implemented a Linux feature request made by Jakub Jelinek <jakub@redhat.com> that enhances lsof's ability to locate UNIX domain sockets whose paths are named as arguments. Jakub supplied suggested code.

Dropped *claims* that lsof works on AIX below 5.1, SCO Openserver 5.0.4, Tru64 UNIX 5.0, and UnixWare below 7.1.4. Lsof will probably build and work on those UNIX dialect versions, but I no longer have any way to test lsof on them.

Added support for FreeBSD 5.3 and 6.0. The FreeBSD 5.3 support hasn't been tested.

Added FD test code that will allow dialect versions to test FD option selections. Used the new code in the PSTAT-based HP-UX lsof to enable it to avoid scanning the mount table when its information is not needed. The addition was made in response to a query from Harvey Garner <Harvey.Garner@championusa.com> about lsof performance in a busy NFS environment.

Upgraded lsof's AIX support level to AIX 5.3, based on a report from Dick Dunbar <Dick.Dunbar@Siebel.com>. (I have not tested lsof under AIX 5.3.) Based on Dick's recommendation and local testing changed the C for AIX version 6 and higher -qmaxmem option value to -1.

Made LSOFF_AR environment variable more useful and documented it in 00XCONFIG.

Corrected the use of sum(1) to generate signatures for the lsof distribution and binaries to match the documentation that claims it is sum -r output. Jin Guojun <jin@george.lbl.gov> noticed and reported the problem.

Tested under OpenBSD 3.6.

Added checksum and GPG certificate files for the bz2, gz and Z lsof distribution archives. The new files reside with the distribution archives and supplement the signature information already inside the archives.

Validated on Solaris 10, i8xpc, build s10_63.

4.74 January 17, 2005

Fixed a Solaris segment fault bug on systems that lack a /dev/allkmem device. Offered the fix as a patch to lsof 4.73. The bug was reported by Donald Zoch <donald.zoch@amd.com>.

Updated lsof for FreeBSD 6.0 and higher for a change in <sys/vnode.h>, based on a report from Sergey A. Osokin <osa@FreeBSD.ORG>. Made the update available in a 4.74 'A' edition pre-release.

Filed an HP bug report about missing pstat(2) CWD info for LOFS on HP-UX 11.11 and higher. The missing CWD info was noticed by Ermin Borovac <e.borovac@bom.gov.au>. Added info to 00FAQ about the problem, which can cause the lsof test suite's LTbasic test to fail.

Updated the q4-generated tcp_s.h in the lsof distribution and added socket option support for HP-UX 11.00. Erwin Reyns <ereyns@europarl.eu.int> helped test.

Updated for Solaris 10, build s10_69, with a patch supplied by Mike Miscevic <miscevic@hotpop.com>.

Added v_path support to Solaris 10 lsof. That relieves it of having to read and decode the kernel DNLC, and delivers full paths more reliably.

Added specialized NFS4 support to Solaris 10 lsof.

Applied Solaris 10 patches to lsof supplied by Casper Dik <casper@holland.sun.com>.

Updated lsof for NetBSD 2.99.10 and tested it on a system provided by Andrew Brown <atatat@atatdot.net>.

Added support for the FreeBSD 6.0-CURRENT f_vnode pointer in the file structure.

Added BSDI, FreeBSD, NetBSD and OpenBSD support for the *effnlink member of the inode structure. This makes the lsof LTnlink test run faster on all modified dialects and correctly on OpenBSD.

Added ptyfs support for NetBSD, using modifications provided by Andrew Brown.

Changed the netbsd Configure stanza to look by default for system header files in both /usr/include and /usr/src. (The NETBSD_SYS environment variable can still be used to select an alternate for /usr/src.)

Corrects two FreeBSD 4.10 RPC/XDR type definitions.

Added an FAQ Q&A about setuid and setgid restrictions in HP-UX 11.11. The information in the answer was supplied by Frank Sanders <frank.sanders@siemens.com>.

Added abbreviations for AXI FCIO and FSNAPSHOT file flags. Holger VanKoll <Holger.VanKoll@swisscom.com> reported the missing FCIO.

Adjusted lsof's private AIX 64 bit rnode structure for 64 bit AIX 5.2 systems. (IBM doesn't distribute a correct <nfs/rnode.h> for it.)

Corrected a Linux socket inode printing bug reported by Igor Schein <igor@txc.com>.

Updated for FreeBSD 4.11. The support compiles but hasn't been tested.

Back-ported a FreeBSD 6.0-CURRENT fix to FreeBSD 5.3-RELEASE-p1. That was done to solve a compilation problem reported by Radko Keves <rado@daemon.sk>.

4.75 May 16, 2005

Dropped the *claim* that lsof works on DEC OSF/1 and Digital UNIX, since my last 4.0 test system has been removed. The last tested distribution of lsof on DEC OSF/1 and Digital UNIX was revision 4.74. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

Added negation forms to the values in the -g (PGID) and -p (PID) lists. Negated PGID and PID values, like negated UID or login name values, are applied without ORing or ANDing and take effect before any other selection criteria are applied.

At the request of Marcin Gozdalik <gozdal@gmail.com> added a -X option for Linux. The option inhibits the reading of the /proc/net/tcp* and /proc/net/udp*

files.

Based on a report from David Gutierrez
<davegu1@hotmail.com> changed DEC OSF/1 process table
allocation to request memory in smaller increments.

Based on a report from jayjwa <jayjwa@atr2.ath.cx>
updated the Customize script to use "tail -n 1" where
possible.

Enabled support for FreeBSD 5.4.

Improved the BSDI, FreeBSD, NetBSD, OpenBSD and Solaris
kvm_open() and kvm_openfiles() error messages.

Enabled support for NetBSD 2.99.12.

Improved HP-UX Configure stanza with help from Piet
Starreveld <pstarrev@csc.com>. Picked some lint Piet
found.

Enabled IPv6 support for HP-UX > 11. Piet Starreveld
helped test it on 11.23, among others.

Updated for HP-UX 11.23 on the ia64 architecture.

Updated to latest FreeBSD 6.0-CURRENT, using a test
system provided by Andrzej Tobola <ato@iem.pw.edu.pl>.

Added support for SCO OSR 6.0.0 and UnixWare 7.1.4 with
help from Richard at SCO.

Corrected a Linux bug in NFS handling, reported by Karel Zak
<kzak@redhat.com>. Karel supplied a patch.

Improved the code for accessing an AIX 3.2 and higher
sockaddr_un structure, thus eliminating a segmentation
fault possibility.

Updated for AIX 5.3.

Added preliminary (DEBUG) support for the AIX SANFS
file system.

Fixed a bug in the Solaris 10 processing of the vnode's
v_path pointer with code supplied by Edward Jajko
<ejajko@portal.com>. The fix was offered as a patch to
4.74.

Dropped support for OpenUNIX 8, since a test system is no longer available. Archived an OpenUNIX-only distribution of the last revision (4.74) tested on OpenUNIX in pub/tools/unix/lsof/OLD/src.

Tested under Openbsd 3.7.

Tested under Darwin 7.7.0.

Enabled building on amd64 Solaris 10 with hints from Marc Aurele La France <tsi@ualberta.ca>. Marc provided a test system.

Supplied a missing quote in the FreeBSD Configure stanza. Carl Cook <Info@quantum-sci.com> reported the problem.

Removed "-O" option from tests/Makefile so that the HP-UX bundled compiler won't complain.

4.76 August 30, 2005

Corrected an example and spelling errors in man page.

Updated for Apple Darwin 8.x with changes supplied by Allan Nathanson <ajn@apple.com>. Allan also provided a test system.

Completed documentation of CLRLFILEADD in all machine.h files.

At the request of Chris Markle <cmarkle@sendmail.com> added partial listen queue length to socket options displayed when -Tf is specified. Partial queue length is not reported for all dialects. (OOFAQ lists the ones where it is reported.)

Updated for FreeBSD 7.0 with information supplied by Andrzej Tobola <ato@iem.pw.edu.pl>.

Updated Solaris VxFS support for VxFS versions 4 and above with technical advice from Craig Harmer <craig_harmer@symantec.com>, Gary Millen <gary_millen@symantec.com> and Chuck Silvers <charles_silvers@symantec.com>. Testing help was provided by Michael Antlitz <mantlitz@prophasys.com>, Steve Ginsberg <steve@dhapdigital.com> and Kenneth Stailey <kstailey@yahoo.com>.

Fixed a Solaris address space map processing bug. Janardhan Molumuri <mjanardhan@gmail.com> reported the bug and help me identify it. Made the fix available as a patch to 4.75.

Added support for Solaris 10 port and CTFS files. The CTFS support is incomplete, because I don't know how to get inode number, size and link count. (There's a new 00FAQ entry about that.)

Investigated a report from Christopher J Warweg <warwegc@GAO.GOV> that the CHECKSUMS for the lsof 4.75 binary for 64 bit Solaris 8 was incorrect. It was my packaging error. I rebuilt and repackaged the binary.

Enabled support for Linux map file names with embedded spaces.

4.77 April 10, 2006

Added -X option support for Solaris 10 and above. When -X is specified lsof will report cached v_node path names for unlinked files, followed by "(deleted)".

Improved cached vnode path name handling by adding "(?)" to the end of path names of questionable accuracy.

Updated 00FAQ to reflect these changes.

Updated for FreeBSD 7.0-CURRENT.

Fixed name addition spacing bug, reported by Stuart Anderson <anderson@ligo.caltech.edu>. Also updated Solaris 10 SAMFS support at Stuart's request.

Added missing "break;" and another HASSTATVFS test to the NetBSD and OpenBSD dnode.c. Bill Behr <bbeh@networkstoragecorp.com> reported those needs.

Fixed an HP-UX 11 file descriptor "chunk" size problem, reported by Per Allansson <per@appgate.com>. Per helped devise the fix and tested it. This fix was offered as a patch to lsof 4.76.

Updated for FreeBSD 6.0-STABLE and FreeBSD 6.1-PRERELEASE.

Updated scripts/sort_res.perl5 with changes supplied by Frederick Fabian <fabian.frederick@skynet.be>, the author of the script.

Corrected +|-M man page documentation error, reported by Roger Cornelius <rac@tenzing.org>.

Improved FreeBSD user device random seed generation in response to a problem report from Danny Braniss <danny@cs.huji.ac.il>.

Eliminated three syntax error bugs and other compiler complaints from the PSTAT-based lsof. H. Merijn Brand <h.m.brand@xs4all.nl> reported the problems and tested the fixes.

Eliminated compiler complaints in the test suite.

Investigated problems with the building of lsof on PA-RISC HP-UX 11.23, based on a report from John Orndorff <John.Orndorff@sungard.com>. Found that neither the HP bundled C compiler nor gcc would build lsof, but the the HP unbundled ANSI C compiler would. Concluded that HP bundled C compiler can't handle <gssapi/gssapi.h>. Devised a work-around to gcc's omission of the rpercent structure definition of <netdb.h> that allows it to compile lsof's print.c, but the resulting binary doesn't run reliably. Documented the situation in 00FAQ.

Changed reporting of unknown file types. The number of an unknown type is now reported as four octets. The change was made in response to a Linux lsof bug report from Karel Zak <kzak@redhat.com>.

Dropped the *claim* that lsof works on BSDI BSD/OS since my last test system has been removed. The last tested distribution of lsof for BSDI BSD/OS was revision 4.76. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

As a result of discussing the lsof source tar's MD5 checksum with Andrew Bell <andrew.bell.ia@gmail.com>, changed the description of a suitable MD5 tool in the lsof distribution's documentation to name the openssl "dgst" command.

Enabled compilation on Solaris 10 1/06 with a fix sent by Jason Fortezzo <fortezza@mechanicalism.net>. Made the fix available as a patch to 4.76.

Adjusted to FreeBSD 5.5-PRERELEASE.

Corrected a bug in the lsof library's process_file() function to enable the locating of AIX XTI sockets by their TCP/IP address values. The bug was reported by Michel Dubois <Dubois@sears.ca>.

Based on a bug report from Karel Zak <kzak@redhat.com> added command name length checking to as many dialects as possible (Linux for Karel) for the "-c c" option.

Updated for OpenBSD 3.[89]. Tested the 3.9 update on a system provided by David Mazieres. I have not tested on OpenBSD 3.8, but David reports lsof 4.76 worked there.

Ended regression testing of lsof on 32 bit Solaris 8 with the ending of access to a test system. Lsof continues to be tested on 64 bit Solaris 8.

4.78 April 24, 2007

Added more information to the lsof FAQ about missing link counts and sizes on Linux files.

Simplified Linux stat() and lstat() usage.

Relocated #define's that prevent OpenBSD compilation on systems without a /proc file system. Pieter Bowman <bowman@math.utah.edu> reported the problem.

Added code to avoid processing Linux /proc/<PID>/maps file entries with zero device and node numbers. Some such entries now have names associated with them that are not path names -- e.g., "[heap]", "[stack]" or "[vdso]". Scott Worley <sworley@chkno.net> reported lsof's mishandling of such entries.

Added SELinux security context support, provided by James Antill <james.antill@redhat.com>. I have not tested this, but James and Karel Zak <kzak@redhat.com> have.

Added the #include of <sys/types.h> to Solaris lsof to enable compilation on Solaris 10 6/06. Peter Harvey Peter.Harvey@Sun.COM diagnosed the problem and supplied a patch.

Added better support for JFS2 on AIX 5.2 and 5.3, based

on bug reports and help from Thomas Braunbeck
<BRAUNBEC@de.ibm.com> and Tom Whitty <TWHITTY@cerner.com>.

Documented that lsof supports AIX 5.3 only up through
maintenance level 1 (ML1).

Enabled Solaris lsof to locate the AFS vnode operation
address for OpenAFS 1.4.1. The fix was supplied by
Robert Jelinek <Robert.Jelinek@MorganStanley.com>.

Enabled support for Solaris 10 ZFS. If the necessary
ZFS header files aren't found, lsof offers the option
to drop ZFS support, to use internal, possibly
inaccurate structure definitions, or to supply a path
to the missing header files. Horst Scheuermann
<Horst.Scheuermann@uni-trier.de> provided a development
system and helped test the support.

Corrected a typo in the man page, reported by Eric S.
Raymond <esr@thyrsus.com>.

Changed the spelling of macroes to macros in lsof
source and documentations files, based on a suggestion
from Josh Soref <timeless@gmail.com> and verification
with the OED.

The following dialects are no longer supported: 32 bit
AIX 5.2, HP-UX 11, OpenStep 4.2, Solaris 2.6, Solaris
8, True Unix 64 and UnixWare 7.1.4. Lsof may work on
them, but I no longer have test systems for them.
Support for OpenBSD ends at its version 3.9 for lack of
interest in the port.

4.79 April 15, 2008

***** IMPORTANT NOTE *****

* *
* Lsof support has been reduced to the following *
* dialects: AIX, FreeBSD, Linux and Solaris, and *
* only in selected versions of those dialects. *
* The selected versions are listed in this file *
* and in other lsof documentation. *
* *
* I have made this move because of retirement *
* and because I no longer have many test systems *
* available to me. *
* *
* Vic Abell *

*

*

Fixed a Solaris VXFS permission problem when accessing the VXFS inode offsets. The bug was reported by Gregory A. Ivanov <ivga@mts.ru>. Gregory tested the fix.

Moved an #include <string.h> later in FreeBSD dlsof.h to enable compilation on recent FreeBSD releases. The change was supplied by Roy Marples <uberlord@gentoo.org>.

Improved Linux /proc file stream reading speed by applying an expanded version of a patch from Eric Dumazet <dada1@cosmosbay.com> that allocates a page size buffer to each stream. Improved TCP, TCP6, UDP and UDP6 hashing by determining the hash bucket count from the /proc/net sockstat and sockstat6 files. The improvement was suggested by Eric and he provided sample code. Eric also tested both improvements.

Modified Configure script to build lsof on FreeBSD 6.2. Tested it on a system provided by Larry Rosenman <ler@lerctr.org>.

Fixed a Linux maps file processing bug that prevented path names from having an embedded colon. James Lingard <jchl@arastra.com> reported the bug and helped with its fix.

Based on reports from Eric Dumazet and Samuel Thibault <samuel.thibault@ens-lyon.org> added support for the Linux 2.6.22 kernel's /proc/<PID>/fdinfo files -- i.e., file offset and flags. Samuel Thibault provided a test system.

Fixed a Linux UNIX socket memory leak, reported by Phillip Shin <pshin@xceedium.com>. Phillip supplied the fix.

With generous assistance from HP added support for an HP-UX 11.23 patch that makes TLI/XTI socket address information available.

Fixed a header file problem for FreeBSD 6.2 on the Alpha architecture. The problem was reported by Pekka Honkanen <phonkane@cc.hut.fi>. Pekka tested the fix.

Based on a report and using suggested fixes from Karel Zak <kzak@redhat.com>, made these changes to Linux lsof: corrected a getpidcon() error message; insured that inode numbers are handled correctly for their unsigned long long type; and improved SELinux handling. At the request of Alon Bar-Lev <alonbl@gentoo.org> added the LINUX_HASSELINUX environment variable to enable or inhibit SELinux support unconditionally.

Updated Configure for FreeBSD 8.0-CURRENT and tested lsof on AMD64 there.

Added a patch provided by Oles Hnatkevych <don_oles@able.com.ua> for FreeBSD systems where the root file system is on a CD9660 device.

Added compensation for the disappearance of FMARK and FDEFER from the FreeBSD 8.0-CURRENT <sys/file.h>.

Updated FreeBSD lsof with ZFS support. Larry Rosenman <ler@lerctr.org>, Erwin Lansing <erwin@FreeBSD.org>, Wesley Shields <wx@atarininja.org> and Dmitry Morozovsky <marck@rinet.ru> provided test systems.

Fixed a socket file identification problem reported by Pavol Rusnak <stick@gk2.sk>. Pavol also reported the cause of the problem.

Added the ability to format the repeat mode marker line with strftime(3), where the dialect supports the localtime(3) and strftime(3) C library functions. The addition was suggested by Mike Depot <mdepot@comcast.net>, who also tested it. The addition required creating a new main lsof source module, util.c, that contains functions whose compilation conflicts with the general header file tree defined by lsof.h and dlsof.h.

Based on reports from Andrei V. Lavreniyuk <andy.lavr@reactor-xg.kiev.ua> and Pav Lucistnik <pav@FreeBSD.org> updated the FreeBSD 7.0 and above file lock handling to use new locking structures. The update requires a terrible hack to get a definition for the lock owner structure from a kernel source module into a local lsof header file.

4.80 May 12, 2008

Updated for a FreeBSD 7.0 and above byte level locking change. The problem was reported by Conrad J. Sabatier <conrads@cox.net>, who helped test the update. Wesley

Shields <wxs@FreeBSD.org> provided an 8.0-CURRENT test system.

Propagated the FreeBSD 7.0 and above locking changes to FreeBSD 6.x, based on a report from Edwin Groothuis <edwin@FreeBSD.org>.

Added warnings for unsupported dialects or versions.

Added Linux support for the UDPLITE protocol. Eric Dumazet <dada1@cosmosbay.com> supplied a patch.

Added a missing quote to the Configure script's FreeBSD stanza.

Added a usage.o rule to the HP-UX PSTAT-based Makefile. I mistakenly deleted the rule at revision 4.79. The missing rule was reported by Kawaljeet Kaur <kawaljeet.malviya@gmail.com> who tested the corrected Makefile.

4.81 October 21, 2008

Updated the Darwin libproc sources with changes from Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc.

Changed dummy declarations in library source files to eliminate complaints about unused variables and empty object files. This change may not work on dialects I can no longer test; it has been tested on some versions of AIX, Darwin, FreeBSD, Linux and Solaris.

At the request of Hal Brooks <hal@uga.edu> added support for Linux /proc/net/packet files. Hal tested it.

Added socket file only performance enhancements to Linux and PSTAT-based HPUX lsof.

Added htonl call around improper usage of INADDR_LOOPBACK; report from an Apple engineer forwarded by Allan Nathanson <ajn@apple.com>.

Adjusted for FreeBSD-8.0 change in device number handling. The adjustment should work for FreeBSD 5 and above, should the 8.0 change be propagated downward. The problem was reported by Pav Lucistnik <pav@FreeBSD.org>. An updated test system was provided by Erwin Lansing <erwin@FreeBSD.org>.

Reduced AIX support to version 5.3, since test systems with older versions are no longer available to me.

At the request of Marjo F. Mercado <mmercado@xceedium.com> and Phil Shin <pschin@xceedium.com> applied some speed improvements to lsof, particularly when the files of interest are /Internet files -- i.e., selected with lsof's -i" option. Added a two new options to assist the improvements: 1) "-c^<command>" to tell lsof to exclude the named command(s); and 2) "-stcp|ud>:[^]state'" to tell lsof to include in its reporting or exclude (^) from its reporting Internet files in the named states (e.g., LISTEN, ^CLOSE_WAIT, IDLE, etc.) For the most part these changes apply only to AIX, Darwin, FreeBSD, PSTAT-based HP-UX, Linux and Solaris, since those are the only places I could test them. They are controlled by the HASTCPUDPSTATE definition in each dialect's machine.h header file. Marjo and Phil provided HP-UX 11.23 and 11.31 test systems.

Fixed a stat(2) problem on HP-UX 11.31 while testing the speed improvements.

Adjusted for kernel header file changes in FreeBSD 8.0-CURRENT. Larry Rosenman <ler@lerctr.org> provided a test system.

Added a warning for Solaris systems where VxFS node info can't be obtained from the VxFS utility library. The warning was requested by Tom Matthews <Tom.MATTHEWS@rbs.com>.

Corrected mishandling of file system path name arguments that have trailing slashes, except, of course, the root file system, "/". Allan Nathanson <ajn@apple.com> reported the bug.

4.82 March 25, 2009

Corrected an over-zealous exclusion test that caused lsof to report nothing when it was given no arguments and built with HASSECURITY and HASNOSOCKSECURITY enabled. Joshua Kinard <kumba@gentoo.org> reported the bug and supplied information for reproducing it.

Based on a report from Dan Trinkle <trinkle@cs.purdue.edu> corrected use of <sys/utsname.h> for 32 bit Solaris 10 and above compilations. Simultaneously eliminated a casting complaint in arg.c and updated Configure to use the appropriate 64 bit compilation option (-xarch=v9 or -m64) with the Solaris Sun C compiler.

Updated for FreeBSD 7.1-PRERELEASE with information supplied by Larry Rosenman <ler@lerctr.org>.

Updated the Darwin libproc sources with changes from Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc. Allan also provided man page corrections.

Updated the FreeBSD Makefile to use the `{MAKE}` variable for ZFS dnod2.c module compilation, based on a suggestion from Alexis Ballier <aballier@gentoo.org>.

Improved the Solaris VxFS library location test, based on a suggestion from Jason Fortezzo <fortezza@mechanicalism.net>. Jason tested the change.

Updated Solaris 10 ZFS support for ZFS version 4 and ZFS pool version 10, using a test system kindly provided by Vladislav Nespov <vladislav.nespov@id.ethz.ch>. Renata Maria Dart <renata@slac.stanford.edu> tested on ZFS version 4, verifying that the update works there, too. (ZFS pool version 10 is apparently the ZFS version shipped with the 10/08 update to Solaris. The original ZFS support targeted ZFS version 3.)

I still consider ZFS support in Solaris lsof a hack, because it depends on a znode structure definition that I developed using dbx. Sun is remiss in not distributing the ZFS header files used to build the distributed kernel.

Because of the znode structure definition hack, I can't guarantee that lsof ZFS support will work for any other versions of ZFS.

Solaris 10: adjusted to a change in the way devices are stored in the kernel; fixed a problem in zone handling; and added rudimentary sharedfs support. Carson Gaspar <carson@taltos.org> reported the device number problem, provided a test system, and tested the changes. Peter Vines <psv2b@eservices.virginia.edu> reported the zone handling problem and tested the fix.

Adapted to FreeBSD 8.0-CURRENT changes in device number computation. Problem was reported by Erwin Lansing <erwin@FreeBSD.org>. Larry Rosenman <ler@lerctr.org> provided a test system.

Corrected Solaris Configure test for appropriate VxFS library when using gcc to compile lsof.

Updated for loss of KAME IPv6 FreeBSD accommodations.

Adapted to FreeBSD 7.2. Made Configure script recognized FreeBSD 6.3.

4.83 January 18, 2010

Converted Solaris 10 and above ZFS support to use the CTF debugger library, libctf. Code was supplied by Robert Byrnes <Robert.Byrnes@deshaw.com>.

Corrected a typo in the testing of the LINUX_HASSELINUX environment variable in the Configure script. The error was reported by Mike Frysinger <vapier@gentoo.org>. At Mike's request made Configure script accept LSOF_RANLIB (ranlib command), LSOF_CFGF (additional configuration flags) and LSOF_CFGL (additional library specifications) from the environment.

Enabled compilation of Solaris 10 lsof after a recent Sun patch which changed the PC file system's structure. Peter Vernam <pvernam@draper.com> reported the problem and helped with the fix.

Made the sort of configuration CFLAGS in the CkTestDB script impervious to locale settings.

Ported to Solaris 11, using a test system kindly provided by David Day <dday76@gmail.com>.

Adjusted to the disappearance of <nfs/rpcv2.h> in FreeBSD 8.0-BETA1.

Changed Solaris node type lookup to a hashed method and added some ability for it to handle duplicate vnodeop names in /dev/ksyms.

Updated for FreeBSD 9.0-CURRENT. Andrzej Tobola <ato@iem.pw.edu.pl> provided a test system. Extends the fix to FreeBSD 6.0 and above via a Configure test and a compile-time definition. The need for the extension was reported by Erik Trulsson <ertr1013@student.uu.se>>

Made corrections to FAQ typographical errors, suggested by Josh Soref <timeless@gmail.com>.

Added `__UCLIBC__` test to Linux `dlsof.h` so `lsof` would compile on an Intel ARM XScale processor. The addition was provided by Doug Kehn <rdkehn@yahoo.com>.

Added test for `<utmpx.h>` to FreeBSD configuration. Improved its use in `lsof.h`. The changes were supplied by Martin Wilke <miwi@FreeBSD.org>.

4.84 July 29, 2010

Fixed a man page `nroff` command error with a correction supplied by Josh Soref <timeless@gmail.com>.

Made `Configure` script recognize FreeBSD 7.3. Larry Rosenman <ler@lerctr.org> provided a test system.

Improved task support, initially for Linux only, with help provided by Jerome Marchand <jmarchan@redhat.com> and Miklos Szeredi <mszeredi@suse.cz>. The support includes a new compile-time definition, `HASTASKS`, and a new run time option, `"-K"` to select task reporting.

While adding help output support for `"-K"`, reorganized the printing of help columns to make it much easier to add a new option description.

Updated the Solaris PC file system structure patch in revision 4.83 so it will compile with `gcc`.

Disabled the Solaris `lgrp_root` work-around in the Solaris `machine.h` so it won't cause compilation problems on Solaris 11. It no longer causes compilation problems on my Solaris 9 and 10 test systems, but some older Solaris 9 and 10 versions may still need it, so the work-around was left in the Sun `machine.h` and a FAQ entry was created about it.

Updated for Solaris 11 b134, using a test system kindly provided by Carson Gaspar <carson@taltos.org>. Made provisions for the next ZFS version. Added info about the failure of the `LTnlink` test on ZFS file systems.

Corrected typo in `Configure` script, reported by Dmitry Berezin <dmitryb@oit.rutgers.edu>.

4.85 September 27, 2011

John Dzuberka <Zube@CS.ColoState.EDU> kindly provided a patched Solaris 9 test system with the `lgrp_root` conflict and I was able to devise an automatic work-around for the conflict. The special note in `.../dialects/sun/machine.h` was removed and

the 17.28.1 FAQ entry was modified to reflect the update.

Added a Solaris 11 work-around for a typedef problem with `<sys/mutex.h>`. Carson Gaspar `<carson@taltos.org>` reported the problem and supplied the work-around.

Added support for FreeBSD 7.4 and 8.2; tested on systems provided by Larry Rosenman `<ler@lerctr.org>`.

Added support for 32 bit Solaris 11 lsof with mods supplied by Jan Wortelboer `<J.H.P.Wortelboer@uva.nl>`.

Added Solaris 11 support for using an alternate genunix location. Bill Goodridge `<bill@its.brooklyn.cuny.edu>` reported the alternate location.

Added further Linux cross configuration support to lsof's Configure script. The additional support was supplied by Grant Erickson `<erick205@umn.edu>`. See the descriptions of the `LINUX_*` environment variables in `00XCONFIG` for more information. Tested lsof on Linux kernel 2.6.32 and picked some lint that surfaced during the test.

Added fixes and changes for Apple Mac OS X 10.6, provided by Allan Nathanson `<ajn@apple.com>`. Allan also provided a test system.

Tested on FreeBSD 6.4 i386, using a test system provided by Terry Kennedy `<TERRY@tmk.com>`. Updated for recent FreeBSD ZFS changes on an 8.2 amd64 test system also provided by Terry.

Changed documentation to indicate FreeBSD 7.x is no longer supported, since I no longer have a test system.

Made some changes to the lsof man page, suggested by Navid `<evil1m4chine@googlemail.com>`.

Added compensation for Solaris 10 systems that have patch 144488-10. The patch requires that the new header file `<sys/socket_proto.h>` be included while `_KERNEL` is defined. Brett Bartick `<Brett.bartick@nomura.com>` reported the problem first, followed by Stuart Anderson `<anderson@ligo.caltech.edu>`. Michael Hocke `<michael.hocke@nyu.edu>` suggested a work-around which I refined to limit it to the specific Solaris 10 instance and then tested on a system provided by Charles Stephens `<cfs@cowlabs.com>`

Added the `+|-e` option for Linux. It exempts file systems

named by path from function calls that might block in the kernel -- i.e., stat(2) and lstat(2), and when the +e form is used, readlink (2). The new packager of lsof for the Linux Fedora and RHEL distributions, Peter Schiffer <pschiffe@redhat.com>, asked for the feature so it could be used with Clearcase file systems, whose implementation can block stat(2) calls. I consider this feature very risky and easy to misuse -- e.g., specifying the file system as '/' would exempt all file systems. I don't intend to propagate this option to any other UNIX dialect that lsof currently supports.

Made FreeBSD 9 adjustment.

Fixed a Linux bug that prevented the display of paths for abstract UNIX sockets. Masatake Yamato <yamato@redhat.com> reported the bug and supplied a patch.

Added compensation for the removal of RPC header files from Glibc 2.14 for Linux. Marek Behun <kabel@blackhole.sk> reported the problem and supplied a patch.

Added support for Linux Netlink protocol. Masatake Yamato requested the support and supplied a patch. Peter Schiffer <pschiffe@redhat.com> provided a test system.

Corrected Linux UDP6-lite path. The error was reported by Masatake Yamato and he also supplied a patch.

Vic Abell <abe@purdue.edu>
September 27, 2011

Found in path(s):

* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/00DIST
No license file was found, but licenses were detected in source scan.

Making and Installing lsof 4

```
*****  
| The latest release of lsof is always available via anonymous ftp |  
| from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof.      |  
*****
```

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 - AFS
 - AIX
 - Apple Darwin
 - Auspex LFS (no longer maintained)
 - BSDI BSD/OS
 - DEC OSF/1, Digital UNIX, Tru64 UNIX
 - FreeBSD
 - HP-UX
 - IPv6
 - Linux
 - NetBSD
 - NEXTSTEP and OPENSTEP
 - OpenBSD
 - Pyramid DC/OSx and Reliant UNIX (no longer available)
 - Caldera OpenUNIX
 - SCO OpenServer
 - SCO|Caldera UnixWare
 - Solaris 2.x, 7, 8, 9 and 10
 - Ulrix (no longer available)
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- Installing Lsof
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Cross-configuring Lsof Environment Variables Affecting the Configure Script

===== Pre-built Lsof Binaries =====

Avoid using pre-built lsof binaries if you can; build your own instead.

I do not support lsof binaries built and packaged by third parties nor lsof binaries built from anything but the latest lsof revision. (See the Bug Reports section for more information on the details of lsof support.)

One important reason for those support restrictions is that when lsof is built its Configure script tunes lsof to the features available on the building system, often embodied in supporting header files and libraries. If the building system doesn't have support for a particular feature, lsof won't be built to support the feature on any system.

The Veritas VxFS file system is a good example of a feature that requires build-time support.

UNIX dialect version differences -- Solaris 8 versus 9, AIX 4.3.3 versus 5.2, etc. -- can also render a pre-built lsof binary useless on a different version. So can kernel bit size.

There are so many potential pitfalls to using an lsof binary improperly that I strongly recommend lsof be used only where it is built.

===== Making Lsof =====

```
$ cd <lsof source directory>  
$ ./Configure <your dialect's abbreviation>  
$ make
```

(Consult the 00FAQ and 00XCONFIG files of the lsof distribution for information about using make command invocations and environment variables to override lsof default Makefile strings.)

This lsof distribution can be used with many UNIX dialects. However,

it must be configured specifically for each dialect. Configuration is done in three ways: 1) by changing definitions in the machine.h header file of the UNIX dialect of interest; 2) by defining environment variable values prior to calling Configure (see the 00XCONFIG file, the Environment Variables and Environment Variables Affecting the Configure Script sections of this file); and 3) by running the Configure shell script found in the top level of the distribution directory.

You may not need to change any machine.h definitions, but you might want to look at them anyway. Pay particular attention to the definitions that are discussed in the Security section of this file. Please read that section.

The Configure script calls three other scripts in the lsof distribution: AFSConfig; Inventory; and Customize. The AFSConfig script is called for selected dialects (AIX, HP-UX, NEXTSTEP, and Solaris) to locate AFS header files and determine the AFS version. See The AFSConfig Script section of this file for more information.

The Inventory script checks the completeness of the lsof distribution. Configure calls Inventory after it has accepted the dialect abbreviation, but before it configures the top-level directory for the dialect. See The Inventory Script section of this file for more information.

Configure calls the Customize script after it has configured the top-level lsof directory for the declared dialect. Customize helps you modify some of the important compile-time definitions of machine.h. See the The Customize Script section.

You should also think about where you will install lsof and its man page, and whom you will let execute lsof. Please read the Installing Lsof section of this file for information on installation considerations.

Once you have inspected the machine.h file for the dialect for which you want to build lsof, and made any changes you need, run the Configure script, supplying it with the abbreviation for the dialect. (See the following table.) Configure selects the appropriate options for the dialect and runs the Mksrc shell script in the dialect sub-directory to construct the appropriate source files in the top-level distribution directory.

Configure may also run the MkKernOpts script in the dialect sub-directory to propagate kernel build options to the dialect Makefile. This is done for only a few dialects -- e.g., DC/OSx, and Reliant UNIX.

Configure creates a dialect-specific Makefile. You may want to inspect or edit this Makefile to make it conform to local conventions. If you want the Makefile to install lsof and its man page, you will have to create an appropriate install rule.

Lsof may be configured using UNIX dialect abbreviations from the following table. Alternative abbreviations are indicated by a separating `|'. For example, for SCO OpenServer you can use either the ``osr" or the ``sco" abbreviation:

```
$ Configure osr
or
$ Configure sco
```

Abbreviations UNIX Dialect

aix	IBM AIX 5.[23] and 5.3-ML1 using IBM's C Compiler
aixgcc	IBM AIX 5.[12] and 5.3-ML1 using gcc
darwin	Apple Darwin 7.x and 8.x for Power Macintosh systems
decosf	DEC OSF/1, Digital UNIX, Tru64 UNIX 4.0 and 5.1
digital_unix	Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
du	Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
freebsd	FreeBSD 4.x, 4.1x, 5.x and [67].x
hpux	HP-UX 11.00, 11.11 and 11.23, using HP's C Compiler, both /dev/kmem-based and PSTAT-based
hpuxgcc	HP-UX 11.00, 11.11 and 11.23, using gcc, both /dev/kmem-based and PSTAT-based
linux	Linux 2.1.72 and above for x86-based systems
netbsd	NetBSD 1.[456], 2.x and 3.x
next	NEXTSTEP 3.[13]
nextstep	NEXTSTEP 3.[13]
ns	NEXTSTEP 3.[13]
nxt	NEXTSTEP 3.[13]
openbsd	OpenBSD 2.[89] and 3.[0-9]
openstep	OPENSTEP 4.x
os	OPENSTEP 4.x
osr	SCO OpenServer Release 5.0.6, using the C compiler from the SCO developer's kit
osrgcc	SCO OpenServer Release 5.0.6, using gcc
osr6	SCO OpenServer 6.0.0, using the SCO C compiler
sco	SCO OpenServer Release 5.0.6, using the C compiler from the SCO developer's kit
scogcc	SCO OpenServer Release 5.0.6, using gcc
solaris	Solaris 2.x, 7, 8, 9 and 10 using gcc
solarisc	Solaris 2.x, 7, 8, 9 and 10 using Sun's cc
tru64	Tru64 UNIX, DEC OSF/1, Digital UNIX 4.0 and 5.1

unixware SCO|Caldera UnixWare 7.1.4

uw SCO|Caldera UnixWare 7.1.4

If you have an earlier version of a dialect not named in the above list, lsof may still work on your system. I have no way of testing that myself. Try configuring for the named dialect -- e.g., if you're using Solaris 2.1, try configuring for Solaris 2.5.1.

After you have configured lsof for your UNIX dialect and have selected options via the Customize script (See the The Customize Script section.) , use the make command to build lsof -- e.g.,

```
$ make
```

Other Configure Script Options

=====

There are three other useful options to the Configure script besides the dialect abbreviation:

-clean may be specified to remove all traces of a dialect configuration, including the Makefile, symbolic links, and library files.

-h may be specified to obtain a list of
-help Configure options, including dialect abbreviations.

-n may be specified to stop the Configure script from calling the Customize and Inventory scripts.

Caution: -n also suppresses the AFSConfig step.

Environment Variables

=====

Lsof configuration, building, and execution may be affected by environment variable settings. See the Definitions That Affect Compilation section in the 00PORTING file, the General Environment Variables section in the 00XCONFIG file, the Dialect-Specific Environment Variables section in the 00XCONFIG file, and the Environment Variables Affecting the Configure Script section of this file for more information.

Note in the General Environment Variables section of the 00XCONFIG file that there are five environment variables that can be used to pre-define values in lsof's -v output: LSOF_BLDCMT, LSOF_HOST, LSOF_LOGNAME, LSOF_SYSINFO, and LSOF_USER.

Security

=====

If the symbol HASSECURITY is defined, a security mode is enabled, and lsof will allow only the root user to list all open files.

Non-root users may list only open files whose processes have the same user ID as the real user ID of the lsof process (the one that its user logged on with).

However, if HASNOSOCKSECURITY is also defined, anyone may list anyone else's open socket files, provided their listing is enabled with the "-i" option.

Lsof is distributed with the security mode disabled -- HASSECURITY is not defined. (When HASSECURITY is not defined, the definition of HASNOSOCKSECURITY has no meaning.) You can enable the security mode by defining HASSECURITY in the Makefile or in the machine.h header file for the specific dialect you're using -- e.g. dialects/aix/machine.h.

The Customize script, run by Configure when it has finished its work, gives you the opportunity to define HASSECURITY and HASNOSOCKSECURITY. (See the The Customize Script section.)

The lsof -h output indicates the state HASSECURITY and HASNOSOCKSECURITY had when lsof was built, reporting:

```
"Only root can list all files;"
if HASSECURITY was defined and HASNOSOCKSECURITY wasn't
defined;
```

```
"Only root can list all files, but anyone can list socket files."
if HASSECURITY and HASNOSOCKSECURITY were both defined;
```

```
"Anyone can list all files;"
if HASSECURITY wasn't defined. (The definition of
HASNOSOCKSECURITY doesn't matter when HASSECURITY isn't
defined.)
```

You should carefully consider the implications of using the default security mode. When lsof is compiled in the absence of the

HASSESECURITY definition, anyone who can execute lsof may be able to see the presence of all open files. This may allow the lsof user to observe open files -- e.g., log files used to track intrusions -- whose presence you would rather not disclose.

All pre-compiled binaries on lsof.itap.purdue.edu and mirrored from it were constructed without the HASSECURITY definition.

As distributed, lsof writes a user-readable and user-writable device cache file in the home directory of the real user ID executing lsof. There are other options for constructing the device cache file path, and they each have security implications.

The 00DCACHE file in the lsof distribution discusses device cache file path construction in great detail. It tells how to disable the various device cache file path options, or how to disable the entire device cache file feature by removing the HASDCACHE definition from the dialect's machine.h file. There is also information on the device cache file feature in the 00FAQ file. (The 00DCACHE and 00FAQ files are part of the lsof distribution package.)

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the compile-time options related to the device cache file. (See The Customize Script section.)

Since lsof may need setgid or setuid-root permission (See the Setgid Lsof Dialects and Setuid-root Lsof Dialects sections.), its security should always be viewed with skepticism. Lest the setgid and setuid-root permissions allow lsof to read kernel name list or memory files, declared with the -k and -m options, that the lsof user can't normally access, lsof uses access(2) to establish its real user's authority to read such files when it can't surrender its power before opening them. This change was added at the suggestion of Tim Ramsey.

Lsof surrenders setgid permission on most dialects when it has gained access to the kernel's memory devices. There are exceptions to this rule, and some lsof implementations need to run setuid-root. (The Setgid Lsof Dialects and Setuid-root Lsof Dialects sections contains a list of lsof implementations and the permissions recommended in the distribution's Makefiles.)

The surrendering of setgid permission is controlled by the WILLDROPID definition in the dialect machine.h header files.

In the end you must judge for yourself and your installation the risks that lsof presents and restrict access to it according to

your circumstances and judgement.

Run-time Warnings

=====

Lsof can issue warning messages when it runs -- e.g., about the state of the device cache file, about an inability to access an NFS file system, etc. Issuance of warnings are enabled by default in the lsof distribution.

Issuance of warnings may be disabled by default by defining WARNINGSTATE in the dialect's machine.h. The Customize script may also be used to change the default warning message issuance state. (See The Customize Script section.)

The ``-w" option description of the ``-h" option (help) output will indicate the default warning issuance state. Whatever the state may be, it can be reversed with ``-w".

Device Access Warnings

=====

When lsof encounters a /dev (or /devices) directory, one of its sub-directories, or one of their files that it cannot access with opendir(3) or stat(2), it issues a warning message and continues. Lsof will be more likely to issue such a warning when it has been installed with setgid(<some group name>) permission; it won't have trouble if it has been installed with setuid(root) permission or is being run under the root login.

The lsof caller can inhibit or enable the warning with the -w option, depending on the issuance state of run-time warnings. (See the Run-time Warnings section.)

The warning messages do not appear when lsof obtains device information from a device cache file that it has built and believes to be current or when warning message issuance is disabled by default. (See the "Caches -- Name and Device" section for more information on the device cache file.)

The lsof builder can inhibit the warning by disabling the definition of WARNDEVACCESS in the dialect's machine.h or disable all warnings by defining WARNINGSTATE. WARNDEVACCESS is defined by default for most dialects. However, some dialects have some device directory elements that are private -- e.g., HP-UX -- and it is more convenient for the lsof user if warning messages about them are inhibited.

Output from lsof's -h option indicates the status of WARNDEVACCESS.

If it was defined when lsof was compiled, this message will appear:

```
/dev warnings = enabled
```

If WARNDEVACCESS was not defined when lsof was compiled, this message will appear instead:

```
/dev warnings = disabled
```

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the WARNDEVACCESS definition. (See The Customize Script section.)

NFS Blocks

```
=====
```

Lsof is susceptible to NFS blocks when it tries to lstat() mounted file systems and when it does further processing -- lstat() and readlink() -- on its optional file and file system arguments.

Lsof tries to avoid being stopped completely by NFS blocks by doing the lstat() and readlink() functions in a child process, which returns the function response via a pipe. The lsof parent limits the wait for data to arrive in the pipe with a SIGALRM, and, if the alarm trips, terminates the child process with a SIGINT and a SIGKILL.

This is as reliable and portable a method for breaking NFS deadlocks as I have found, although it still fails under some combinations of NFS version, UNIX dialect, and NFS file system mount options. It generally succeeds when the "intr" or "soft" mount options are used; it generally fails when the "hard" mount option is used.

When lsof cannot kill the child process, a second timeout causes it to stop waiting for the killed child to complete. While the second timeout allows lsof to complete, it may leave behind a hung child process. Unless warnings are inhibited by default or with the -w option, lsof reports the possible hung child.

NFS block handling was updated with suggestions made by Andreas Stolcke. Andreas suggested using the alternate device numbers that appear in the mount tables of some dialects when it is not possible to stat(2) the mount points.

The -b option was added to direct lsof to avoid the stat(2) and

readlink(2) calls that might block on NFS mount points and always use the alternate device numbers. If warning message issuance is enabled and you don't want warning messages about what lsof is doing, use the -w option, too.

The -O option directs lsof to avoid doing the potentially blocking operations in child processes. Instead, when -O is specified, lsof does them directly. While this consumes far less system overhead, it can cause lsof to hang, so I advise you to use -O sparingly.

Caches -- Name and Device

=====

Robert Ehrlich suggested that lsof obtain path name components for open files from the kernel's name cache. Where possible, lsof dialect implementations do that. The -C option inhibits kernel name cache examination.

Since AFS apparently does not use the kernel's name cache, where lsof supports AFS it is unable to identify AFS files with path name components.

Robert also suggested that lsof cache the information it obtains via stat(2) for nodes in /dev (or /devices) to reduce subsequent running time. Lsof does that, too.

In the default distribution the device cache file is stored in .lsof_hostname, mode 0600, in the home directory of the login of the user ID that executes lsof. The suffix, hostname, is the first component of the host's name returned by gethostname(2). If lsof is executed by a user ID whose home directory is NFS-mounted from several hosts, the user ID's home directory may collect several device cache files, one for each host from which it was executed.

Lsof senses accidental or malicious damage to the device cache file with extensive integrity checks, including the use of a 16 bit CRC. It also tries to sense changes in /dev (or /devices) that indicate the device cache file is out of date.

There are other options for forming the device cache file path. Methods the lsof builder can use to control and employ them are documented in the separate 00DCACHE file of the lsof distribution.

Raw Sockets

=====

On many UNIX systems raw sockets use a separate network control block structure. Display of files for applications using raw sockets -- ping, using ICMP, for example -- need special support for displaying their information. This support is so dialect-specific and information to provide it so difficult to find that not all dialect revisions of lsof handle raw sockets completely.

Other Compile-time Definitions

=====

The machine.h and dlsof.h header files for each dialect contains definitions that affect the compilation of lsof. Check the Definitions That Affect Compilation section of the 00PORTING file of the lsof distribution for their descriptions. (Also see The Customize Script section.)

The AFSConfig Script

=====

Lsof supports AFS on some combinations of UNIX dialect and AFS version. See the AFS section of this document for a list of supported combinations.

When configuring for dialects where AFS is supported, the Configure script calls the AFSConfig script to determine the location of AFS header files and the AFS version. Configure will not call AFSConfig, even for the selected dialects, unless the file /usr/vice/etc/ThisCell exists.

The AFS header file location is recorded in the AFSHeaders file; version, AFSVersion. Once these values have been recorded, Configure can be told to skip the calling of AFSConfig by specifying its (Configure's) -n option.

The Inventory Script

=====

The lsof distribution contains a script, called Inventory, that checks the distribution for completeness. It uses the file 00MANIFEST in the distribution as a reference point.

After the Configure script has accepted the dialect abbreviation, it normally calls the Inventory script to make sure the distribution is complete.

After Inventory has run, it creates the file ".ck00MAN" in the top-level directory to record for itself the fact that the inventory has been check. Should Inventory be called again, it senses this file and asks the caller if another check is in order, or if the check should be skipped.

The -n option may be supplied to Configure to make it bypass the calling of the Inventory script. (The option also causes Configure to avoid calling the Customize script.)

The lsof power user may want to define (touch) the file ".neverInv". Configure avoids calling the Inventory script when ".neverInv" exists.

The Customize Script

=====

Normally when the Configure script has finished its work, it calls another shell script in the lsof distribution called Customize. (You can tell Configure to bypass Customize with its -n option.)

Customize leads you through the specification of these important compile-time definitions for the dialect's machine.h header file:

HASDCACHE device cache file control
HASENVDC device cache file environment
variable name
HASPERSDC personal device cache file path
format
HASPERSDCPATH name of environment variable that
provides an additional component
of the personal device cache file
path
HASSYSDC system-wide device cache file path
HASKERNIDCK the build-time to run-time kernel
identity check
HASSECURITY the security option
HASNOSOCKSECURITY the open socket listing option whe
HASSECURITY is defined
WARNDEVACCESS /dev (or /devices) warning message
control
WARNINGSTATE warning message issuance state

The Customize script accompanies its prompting for entry of new values for these definitions with brief descriptions of each of them. More information on these definitions may be found in this file or in the 00DCACHE and 00FAQ files of the lsof distribution.

You don't need to run Customize after Configure. You can run it later or you can edit machine.h directly.

The -n option may be supplied to Configure to make it bypass the calling of the Customize script. (The option also causes Configure to avoid calling the Inventory script.)

The lsof power user may want to define (touch) the file ".neverCust". Configure avoids calling the Customize script when ".neverCust" exists.

Customize CAUTION: the Customize script works best when it is applied to a newly configured lsof source base -- i.e., the machine.h header file has not been previously modified by the Customize script. If you have previously configured lsof, and want to rerun the Customize script, I recommend you clean out the previous configuration and create a new one:

```
$ Configure -clean
$ Configure <dialect_abbreviation>
...
Customize in response to the Customize script prompts.
```

Cautions

=====

Lsof is a tool that is closely tied to the UNIX operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version, and even within a version as vendor patches are applied.

DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER. VENDOR PATCHES INFLUENCE THE VERSION IDENTITY.

On some UNIX dialects lsof versions may be even more restricted by architecture type.

The bottom line is use lsof where you built it. If you intend to use a common lsof binary on multiple systems, make sure all systems run exactly the same OS version and have exactly the same patches.

Warranty

=====

Lsof is provided as-is without any warranty of any kind, either

expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of Isof is with you. Should Isof prove defective, you assume the cost of all necessary servicing, repair, or correction.

License

=====

Isof has no license. Its use and distribution are subject to these terms and conditions, found in each Isof source file. (The copyright year in or format of the notice may vary slightly.)

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*

* Written by Victor A. Abell

*

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*/

Bug Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to

add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND BUG REPORTS ABOUT LSOF TO THE UNIX DIALECT OR DIALECT OPTION VENDOR.

At worst such bug reports will confuse the vendor; at best, the vendor will forward the bug report to me.

PLEASE DON'T SEND BUG REPORTS ABOUT LSOF BINARIES BUILT OR DISTRIBUTED BY SOMEONE ELSE, BECAUSE I CAN'T SUPPORT THEM.

I do support binaries I built, obtained ONLY from lsof.itap.purdue.edu. Before reporting a problem with a lsof.itap.purdue.edu binary, please verify the correctness of the signatures found in its associated CHECKSUMS file.

Before you send me a bug report, please do these things:

- * Make sure you try the latest lsof revision.

- + Download the latest revision from:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof>

- + Verify the signatures of what you have downloaded;

- + While connected to lsof.itap.purdue.edu, check for patches:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/patches>

- + If patches exist, install them in the latest revision you just downloaded. Then build the latest revision and see if it fixes your bug.

- * If you're having trouble compiling lsof with gcc, try the UNIX dialect vendor's compiler. I don't have access to gcc on all test systems, so my support for it is hit-and-miss, and so is my ability to respond to gcc compilation problem reports.

- * Check the lsof frequently asked questions file, 00FAQ, to see if there's a question and answer relevant to your problem.

- * Make sure you're running the lsof you think you are by checking the path to it with which(1). When in doubt, use an absolute path to lsof. Make sure that lsof binary has

sufficient permissions to do what you ask, including internal permissions given it (e.g., restrictions on what files lsof may report for whom) during its build.

When you send a bug report, make sure you include output from your running of lsof's Configure script. If you were able to compile a running lsof, please also include:

- * Output from which(1) that shows the absolute path to the lsof binary in question;
- * Output from running lsof with its -h and -v options at lsof's absolute path;
- * Output from "ls -l" directed to lsof's absolute path.

If you weren't able to compile a running lsof, please send me: the compiler error output; identification of the lsof revision you're using (contents of the lsof version.c file); identification of your system (full uname output or output from whatever other tool identifies the system); and compiler identification (e.g., gcc -v output).

Either set of output will help me understand how lsof was configured and what UNIX dialect and lsof revision is involved.

Please send all bug reports, requests, etc. to me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

The 00FAQ File

=====

The lsof distribution contains an extensive frequently asked questions file on lsof features and problems. I recommend you consult it before sending me e-mail. Use your favorite editor or pager to search 00FAQ -- e.g., supplying as a search argument some fixed text from an lsof error message.

The lsof-l Mailing List

=====

Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

Field Output Example Scripts

=====

Example AWK and Perl 4 or 5 scripts for post-processing lsof field output are located in the scripts sub-directory of the lsof distribution. The scripts sub-directory contains a README file with information about the scripts.

Field Output C Library

=====

The lsof test suite (See "Testing Lsof."), checks basic lsof operations using field output. The test suite has its own library of C functions for common test program operations, including processing of field output. The library or selections of its functions could be adapted for use by C programs that want to process lsof field output. See the library in the file LTlib.c in the tests/ sub-directory

Testing Lsof

=====

Lsof has an automated test suite in the tests/ sub-directory that can be used to test some basic lsof features -- once lsof has been configured and made. Tests are arranged in three groups: basic tests that should run on all dialects; standard tests that should run on all dialects; and optional tests that may not run on all dialects or may need special resources to run. See 00TEST for more information.)

CAUTION!!! Before you attempt to use the test suite make sure that the lsof you want to test can access the necessary kernel resources -- e.g., /dev/mem, /dev/kmem, /proc, etc. Usually you want to test the lsof you just built, so this is an important check. (See 00TEST.)

To run the basic and standard tests, using the lsof in the parent directory of tests/, do this:

```
$ cd tests
$ make test
  or $ make std
  or $ make standard
```

The basic and standard tests may be run as silently as possible,

using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make auto
```

This is the "automatic" test mode, designed for use by scripts that build lsof. The caller is expected to test the make exit code to determine if the tests succeeded. The caller should divert standard output and standard error to /dev/null to suppress make's error exit message.

The optional tests may be run, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make opt
  or $ make optional
```

It's possible to execute individual tests, too. See the 00TEST file of this distribution for more information on the tests, what they do, and how to run and possibly customize each test.

It's possible to run the tests, using an lsof other than the one in the parent directory of /tests, too. See 00TEST for information about using the LT_LSOF_PATH environment variable to do that.

```
=====
Dialect Notes
=====
```

AFS
===

Lsof recognizes AFS files on the following combinations of UNIX dialect and AFS versions:

- AIX 4.1.4 (AFS 3.4a)
- Linux 1.2.13 (AFS 3.3)
- NEXTSTEP 3.2 (AFS 3.3) (untested on recent lsof revisions)
- Solaris 2.6 (AFS 3.4a)
- Ultrix 4.2 RISC (AFS 3.2b) (no longer available)

Lsof has not been tested under other combinations -- e.g. HP-UX 10.10 and AFS 3.4a -- and probably won't even compile there. Often when a UNIX dialect version or AFS version changes, the new header files come into conflict, causing compiler objections.

AIX

===

Specify the aix Configure abbreviation for AIX 4.1.[45], 4.2.[1], 4.3.[123], 5L, and 5.[123].

Specify aixgcc on AIX above 4.1 to use the gcc compiler. (Gcc can't be used to compile lsof on AIX 4.1 and below because of kernel structure alignment differences between it and xlc.) Gcc results sometimes depend on the version of the gcc compiler that is used.

Compilation of lsof with gcc on AIX 4.3.[123], 5L, and 5.[123] has been sparsely tested with varying degrees of success: it has been reported to succeed on AIX 4.3.3 and 32 bit Power AIX 5.1; to fail on ia64 AIX 5.1 and 64 bit Power AIX 5.1; and to succeed on 32 and 64 bit Power AIX 5.2. Lsof compilation with gcc hasn't been tested on AIX 5.3.

At revision 4.61 and above lsof is configured and built to match the bit size of the kernel of Power architecture AIX 5.1 systems. Lsof binaries built for 32 and 64 bit kernels are not interchangeable. See 00FAQ for more information.

The Configure script uses /usr/bin/oslevel to determine the AIX version for AIX less than 5 and ``uname -rv" for AIX 5 and higher. If /usr/bin/oslevel isn't executable on AIX less than 5, the Configure script issues a warning message and uses ``uname -rv" to determine the AIX version.

When Configure must use ``uname -rv" on AIX less than 5 to determine the AIX version, the result will lack a correct third component -- e.g., the `4' of ``4.1.4". If your AIX less than 5 system lacks an executable oslevel, I suggest you edit the Configure-produced Makefile and complete the _AIXV definition in the CFGF string.

By default lsof avoids using the kernel's readx() function, causing it to be unable to report information on some text and library file references. The ``-X" option allows the lsof user to ask for the information readx() supplies.

Lsof avoids readx() to avoid the possibility of triggering a kernel problem, known as the Stale Segment ID kernel bug. Kevin Ruderman reported this bug to me. The bug shows up when the kernel's dir_search() function hangs, hanging the application process that called it so completely that the application process can neither be killed nor stopped. The hang is the consequence of another process (perhaps lsof) making legitimate use of the kernel's readx()

function to access the kernel memory that `dir_search()` is examining. IBM has indicated they have no plans to fix the bug.

A fuller discussion of this bug may be found in the 00FAQ file of the `lsf` distribution. There you will find a description of the Stale Segment ID bug, the APAR on it, and a discussion of the sequence of events that exposes it.

I added the ```-X` function so you can tell `lsf` to use `readx()`, but if you use ```-X`, you should be alert to its possibly serious side effects. Although `readx()` is normally disabled, its state is controlled with the `HASXOPT`, `HASXOPT_ROOT`, and `HASXOPT_VALUE` definitions in `dialects/aix/machine.h`, and you can change its default state by changing those definitions. You can also change `HASXOPT_ROOT` via the `Customize` script.

You can also compile `lsf` with `readx()` use permanently enabled or disabled -- see the comments about the definitions in the `dialects/aix/machine.h` header file. You may want to permanently disable `lsf`'s use of `readx()` if you plan to make `lsf` publicly executable. You can also restrict `-X` to processes whose real UID is root by defining `HASXOPT_ROOT`.

I have never seen `lsf` cause the Stale Segment ID bug to occur and haven't had a report that it has, but I believe there is a possibility it could.

AFS support for AIX was added with help help from Bob Cook and Jan Tax who provided test systems.

Henry Grebler and David J. Wilson helped with `lsf` for AIX 4.2.

Bill Pemberton provided an AIX 4.3 test system. Andrew Kephart and Tom Weaver provided AIX 4.3 technical assistance. Niklas Edmundsson did 4.3.1 testing. Doug Crabill provided an AIX 4.3.2 test system. Jeff W. Stewart provided an AIX 4.3.3 test system.

The SMT file type for AIX 4.1.[45], 4.2[.1], and 4.3[.12] is my fabrication. See the 00FAQ file more information on it.

Loc Le and Nasser Momtaheni of IBM provided test systems for AIX 5L and 5.1. `lsf` for AIX 5L and 5.1 needs `setuid-root` permission to process the `-X` option on systems whose architecture type is `ia64`.

Dale Talcott of Purdue provided AIX 5.1 and 5.2 test systems. Dale and John Jackson of Purdue provided an AIX 5.3 test system.

Apple Darwin

=====

The Apple Darwin port was provided by Allan Nathanson for version 1.2. Allan also arranged for access to a test system for maintenance and regression testing. Dale Talcott provided a test system, too.

Allan supplied patches for updates to 1.4, 5.x, 6.x, 7.x and 8.x.

BSDI BSD/OS

=====

As of lsof revision 4.77 support for BSDI BSD/OS has been discontinued. Lsof revision 4.76 with BSDI BSD/OS support may be found on lsof.itap.purdue.edu in `pub/tools/unix/lsof/src`.

DEC OSF/1, Digital UNIX, Tru64 UNIX

=====

Robert Benites, Dean Brock, Angel Li, Dwight McKay, Berkley Shands, Ron Young and Steve Wilson have kindly provided test systems. Jeffrey Mogul has provided technical assistance. Dave Morrison and Lawrence MacIntyre did Digital UNIX V3.2 testing.

Lsof supports the ADVFS/MSFS layered file system product. Lsof can locate all the open files of an ADVFS/MSFS file system when its path is specified, provided the file system is listed in `/etc/fstab` with an ```advfs``` type. (This `/etc/fstab` caveat applies only to Digital UNIX 2.0.) At Digital UNIX 4.0 and Tru64 UNIX, using code provided by David Brock, lsof 4.20 and above can locate ADVFS file paths.

Testing of lsof on DEC OSF/1 and Digital UNIX 4.0 ended with lsof revision 4.74. Hence, the lsof documentation has dropped the claim that it works there. For a distribution of lsof 4.74 that was tested on DEC OSF/1 and Digital UNIX 4.0, check `pub/tools/unix/lsof/OLD/src` on the lsof ftp home, lsof.itap.purdue.edu.

Lsof revisions past 4.74 have only been tested on Tru64 UNIX 5.1.

FreeBSD

=====

Bill Bormann of Purdue University provided access to several FreeBSD test systems. Ade Barkah, John Clear, Ralph Forsythe, Michael

Haro, Kurt Jaeger, and William McVey have also provided FreeBSD test systems.

The FreeBSD distribution header files are augmented by header files in the dialects/freebsd/include directory.

David O'Brien maintains the lsof FreeBSD port package.

HP-UX

=====

Lsof has two HP-UX bases: /dev/kmem for HP-UX 11.0 and earlier; and PSTAT for HP-UX 11.11 and later. The lsof Configure script will pick the appropriate base.

To use the CCITT x.25 socket support for HP-UX, you must have the x.25 header files in /etc/conf/x25

Pasi Kaara helped with the HP-UX port, especially with its CCITT x.25 socket support.

Richard Allen provided HP-UX 10.x and 11.x test systems, as did Mark Bixby, and Elias Halldor Agustsson. Marc Winkler helped test the 10.20 port. Richard J. Rauenzahn provided a 64 bit HP-UX 11 test system and an HP-UX 11.11 development system.

AFS support for HP-UX was added thanks to help from Chaskiel Moses Grundman, who provided a test system.

The /dev/kmem-based HP-UX 11.00 support is extremely fragile. It depends on privately developed kernel structure definitions. (See ../dialects/hpux/hpux11 for the header files making the definitions.) Those header files and their definitions will not be updated by HP-UX 11.00 patches, making it likely that any patch changing a kernel structure critical to lsof will break lsof in some way.

It's possible to build a 64 bit lsof for 64 bit HP-UX 11.00 with gcc, but you must have a gcc compiler capable of producing 64 bit executables. See the 00FAQ file for more information.

The PSTAT-based lsof for HP-UX 11.11 and later is much more solid. I am indebted to the vision of HP for providing an lsof kernel API through the PSTAT implementation. Specifically I appreciate the help of HP staff members Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada that made PSTAT-based HP-UX lsof possible.

IPv6

=====

Lsof has IPv6 support that has been tested for these UNIX dialects: AIX 4.3.x; Apple Darwin 5.[12] and 6.0; the INRIA and KAME FreeBSD IPv6 implementations; PSTAT-based HP-UX; /proc-based Linux; the INRIA and KAME NetBSD implementations; and Solaris 8 and 9. Lsof has IPv6 support that hasn't been tested for: OpenBSD (KAME); OpenUNIX 8; Tru64 Unix 5.[01]; and UnixWare 7.1.[34].

Please let me know if your UNIX dialect has IPv6 support and I'll see if it can be supported by lsof.

Linux

=====

Tim Korb, Steve Logue, Joseph J. Nuspl Jr., and Jonathan Sergent have provided Linux test systems.

Michael Shields helped add and test automatic handling of ELF/COFF form names in /System.map, Marty Leisner and Keith Parks have helped test many lsof revisions. Marty has provided valuable suggestions, Linux hints, and code, too.

The 00FAQ file gives some Linux tips, including information on coping with system map file problems.

To determine the state of the Linux 2.1.x C library lseek() function, the lsof Configure script runs a test program that must have permission to read /dev/kmem. The test determines if the lseek() function properly handles kernel offsets, which appear to be negative because their high order bit is set. If the lseek() test reveals a faulty lseek(), Configure activates the use of a private lseek() function for kernel offset positioning. See the Linux problems section of the 00FAQ file of the lsof distribution for more information.

NetBSD

=====

Greg Earle and Paul Kranenburg have assisted with the NetBSD ports. Paul has provided test systems. Ray Phillips provided a NetBSD Alpha test system. Andrew Brown also provided a test system.

The NetBSD dialect version of lsof is compiled using the dialect

sources it shares with OpenBSD in the n+obsd dialect sub-directory.

NEXTSTEP and OPENSTEP

=====

Virtual memory header files that allow lsof to display text references were derived from the contents of /usr/include/vm of NEXTSTEP 2.0. NeXT did not ship the virtual memory header files with other NEXTSTEP or OPENSTEP versions.

You may use the RC_FLAGS environment variable to declare compiler options outside the Makefile. A common use of this variable is to define the architecture types to be included in a "fat" executable. See the comments in dialects/next/Makefile for an example.

OpenBSD

=====

David Mazieres has provided OpenBSD test systems. The OpenBSD dialect version of lsof is compiled using the dialect sources it shares with NetBSD in the n+obsd dialect sub-directory.

Kenneth Stailey has provided OpenBSD testing and advice.

John Dzuber (Zube) reports, "lsof 4.33 compiles and runs on OpenBSD 2.3 for the pmax architecture (decstation 3100)."

I have not tested lsof on OpenBSD 3.8, but David Mazieres reports revision 4.76 worked on OpenBSD 3.8.

Pyramid DC/OSx and Reliant UNIX

=====

As of lsof revision 4.52 support for all Pyramid dialects has been discontinued. lsof revision 4.51 with Pyramid support may be obtained upon request. Send the request to abe@purdue.edu.

These two UNIX dialects are very similar and share dialect-specific source files from the pyramid sub-directory.

The Reliant Unix Pyramid C compiler issues warning messages that I haven't found a convenient way to suppress. You can ignore warning messages about casts and conversions that lose bits. The message "warning: undefining __STDC__" is intentionally caused by the lsof MkKernOpts configuration script to suppress warning messages

about cast and conversion problems in standard system header files, such as <stdio.h> and <string.h>.

Bruce Beare and Kevin Smith provided test systems.

Caldera OpenUNIX

=====

Larry Rosenman provided an OpenUNIX 8 test system. Matthew Thurmaier provided technical assistance, along with these people from Caldera: Jack Craig, Robert Lipe, and Bela Lubkin.

Robert Lipe supplied changes to lsof for OpenUNIX 8.0.1. Those changes were also incorporated in UnixWare 7.1.3 when it became the release name for OpenUNIX 8.0.1.

Support for lsof on OpenUNIX ended at lsof revision 4.74. The last lsof revision, 4.74, tested on OpenUNIX, may be found at the lsof "home" ftp site, lsof.itap.purdue.edu, in pub/tools/unix/lsof/OLD/src.

SCO OpenServer

=====

Dion Johnson, Bela Lubkin, and Nathan Peterson of SCO gave me copies of SCO OpenServer and the SCO OpenServer Development System 3.0 and provided technical advice for the lsof port.

Hugh Dickins, Bela Lubkin, Craig B. Olofson, and Nathan Peterson provided version 5.0 and gave technical advice for porting lsof to it. Bela provided the 5.0.4 changes. D. Chris Daniels provided a 5.0.4 test system, Lee Penn provided one for 5.0.5, and John Dubois for 5.0.6.

The <netdb.h> header file was accidentally omitted from some SCO OpenServer Development System releases. The Configure script will sense its absence and substitute an equivalent from the BSD distribution. The BSD <netdb.h> and the <sys/cdefs.h> header file it includes are located in the dialects/os/include sub-directory tree.

To compile lsof from its distribution sources you must have the TCP/IP and NSF headers in /usr/include. While those are optional OpenServer packages, I have access to no system that doesn't have them, so I'm unable to build lsof for such a configuration. However, it should be possible to modify the lsof Configure script and sources so lsof would compile and work without those optional

packages.

If you have an OpenServer system configured without the TCP/IP and NFS packages, and want to tackle the job of building lsof for it, contact me via e-mail at <abe@purdue.edu>. I'll identify the Configure script, header file, and source file changes you will need to make. (Caution: this is not a simple task, or I would have already done it.)

The optional osrgcc and scogcc Configure abbreviations construct Makefiles for compiling lsof with gcc.

The UnixWare 7.1.4 sources are used for OpenServer Release 6.0.0. Hence there is a separate Configure abbreviation for it, "osr6". Richard of SCO provided a test system and technical assistance.

SCO|Caldera UnixWare

=====

D. Chris Daniels, John Hughes, Ken Laing, Andrew Merrill, Lee Penn, and Matthew Thurmaier provided test systems. Bela Lubkin provided technical assistance. Larry Rosenman provided 7.1.[34] test systems.

Solaris 2.x, 7, 8, 9 and 10

=====

SEE THE CAUTIONS SECTION OF THIS DOCUMENT.

The latest Solaris revision of lsof 4 might work under Solaris 2.[1-4] and 2.5[.1] and 7 but hasn't been tested there. I have no test systems for those Solaris versions.

Lsof will compile with gcc and the Sun C compiler under Solaris. If you want to use the Sun compiler, use the solariscc Configure abbreviation. If you use a gcc version less than 2.8 on Solaris, make sure the gcc-specific includes have been updated for your version of Solaris -- i.e., run the gcc fixincludes script.

Solaris 7, 8, 9 and 10 support for 64 bit kernels depends on a Sun WorkShop or Forte C compiler version that supports the "-xarch=v9" flag -- usually 5.0 or greater. Gcc versions 2.95 and above *may* be configured and built for 64 bit support, but it takes some extra work, the resulting compiler may be fragile, and the gcc developers discourage it. I've built 64 bit capable gcc compilers for Solaris 7, 8 and 9 from gcc versions 2.95 through 3.0.1 and produced working lsof executables with them. More information on 64 bit gcc for

Solaris may be found in the 00FAQ file.

Solaris 10 ZFS support is questionable, because Sun does not distribute the ZFS kernel structure definition header files. The lsof Configure script and source code use some risky work-arounds. ZFS file system support was made possible with help from Horst Scheuermann.

Dave Curry and Steve Kirsch provided resources for Solaris 2.x ports. Casper Dik and Gerry Singleton consulted and provided valuable assistance.

Henry Katz, Joseph Kowalski, Charles Stephens, Mike Sullivan, and Mike Tracy provided technical assistance.

AFS support was added to Solaris lsof with help from Curt Freeland, Heidi Hornstein, Michael L. Lewis, Terry McCoy, Phillip Moore, and Sushila R. Subramanian.

Casper Dik provided valuable assistance for the Solaris 8 support.

Sun has graciously provided me access to BETA versions of Solaris 2.5, 2.6, 7, 8, and 9.

John Dzuberger provided Solaris 7 and 8 test systems.

Mike Miscevic provided Solaris 10 test systems.

Ultrix

=====

As of lsof revision 4.52 support for Ultrix is no longer available, because I no longer have an Ultrix test system.

Terry Friedrichsen, Dwight McKay, and Jeffrey Mogul helped me with this port.

DECnet support was added to Ultrix lsof with the help of John Beacom, who kindly provided a test system. The Configure script decides that DECnet support is available if /usr/lib/libdnet.a and /usr/include/netdnet/dn.h exist and are readable.

Veritas VxFS and VxVM

=====

Lsof supports some versions of Veritas VxFS and VxVM on some UNIX dialects. Consult the lsof Configure script for the specific

dialect, and consult the lsof dialect-specific source files for the UNIX dialect of interest. Veritas support will usually be found in a source file named dnode[1-9].c.

Since Veritas rarely has a version number that can be extracted with shell commands, lsof doesn't use it. Instead, when lsof supports Veritas, the Configure script will form compile-time definitions starting with HASVXFS. Check the lsof 00PORTING documentation file for more information.

Lsof Veritas support requires that the supporting Veritas header files be installed -- e.g., in /usr/include/sys/fs. (The location will depend in the dialect's header file conventions.)

Some information on lsof support for Veritas extensions may be found in the lsof 00DIST file.

Chris Kordish and Andy Thomas have provided Solaris VxFS test systems.

=====
User-contributed Dialect Support
=====

There are some user-contributed dialect versions of lsof; more information on them can be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib>

Check the 00INDEX file there for details.

=====
Dialects No Longer Supported
=====

Because I don't have access to test systems, these UNIX dialects are no longer supported by lsof:

CDC EP/IX
/dev/kmem-based Linux
MIPS RISC/os
Motorola V/88
Pyramid DC/OSx
Pyramid Reliant UNIX
Sequent DYNIX
SGI IRIX

SunOS 4.x
Ultrix
UnixWare below 7.0

Remnants of the support lsof once provided for these dialects may be found in:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/binaries>
and
<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/dialects>

=====
Installing Lsof
=====

The distributed Makefiles do not have actions that will install lsof. I've come to the conclusion there is no standard for installing lsof or its man page, so I no longer distribute make rules for installing them. You should adjust the Makefile for your local preferences.

The Makefile does have an install rule that will cause lsof to compile by virtue of its dependency clause. Some Makefiles also have a dependency that causes the production of a man page that is ready to install. However, the actions of the install rule will not cause the lsof executable or its man page to be installed in any UNIX system-wide directory.

Instead, after the compilation and optional man page production are completed, the install rule will produce a brief description of what actions you might add to the install rule. The description will suggest the possible modes, ownerships, permissions, and destinations your install rule might employ to install the lsof executable and man page.

As you form your install rule, keep in mind that lsof usually needs some type of special permission to do its job. That may be permission to read memory devices such as /dev/kmem, /dev/mem, or /dev/swap, or it may be authorization to read entries in the /proc file system.

Memory device access can usually be provided by setting the modes of the lsof executable so that its effective group identifier when it runs is the same as the group that has permission to read the memory devices -- i.e., it is setgid-group. The privileged group is usually kmem, sys, or system.

Don't overlook using ACLs -- e.g., on AIX or Solaris 8 -- to give

lsof permission to access memory devices. ACLs, coupled to a separate group like kmem, can be safer than giving lsof setgid authorization to a commonly used system group.

When lsof needs to read /proc file system entries, it must be installed with modes that make its effective user identifier root when it runs -- i.e., it must be setuid-root. If lsof must be installed setuid-root (only the AIX 5L, PSTAT-based HPUX, and /proc-based Linux, ports need such power.), then access to memory devices is automatic (or not needed in the case of /proc-based Linux).

Your choice of permissions for lsof may also be affected by your desire to allow anyone to use it or your need to restrict its usage to specific individuals. You will have to be guided by local policy and convention in this case.

The next two sections, Setgid Lsof Dialect Versions and Setuid-root Lsof Dialect Versions, list recommended install permissions.

The system directory where you install the lsof executable is also open to choice. A traditional place for a tool like lsof is /usr/local/etc, but recent changes in directory structure organization suggest that somewhere in /opt may be more suitable.

Bear one other factor in mind when choosing a location for the lsof executable -- it usually is a shared executable, requiring access to shared libraries. Thus, locations like /sbin or /usr/sbin are probably unsuitable.

Once you've chosen a location for the executable you may find that the location for the man page follows -- e.g., if the executable goes in /usr/local/etc, then the man page goes in /usr/local/man. If the executable location doesn't imply a location for the man page, you'll have to let local custom guide you.

Setuid-root Lsof Dialect Versions

=====

These dialect versions should be installed with setuid-root permission -- i.e., the lsof binary should be owned by root and its setuid execution bit (04000) should be set.

AIX 5L and above for full use of the -X option
Apple Darwin 8.x for Power Macintosh systems
PSTAT-based HP-UX 11.11 and 11.23
/proc-based Linux (generally 2.1.72 and above)

Setgid Lsof Dialect Versions

=====

These dialect versions should be installed with setgid permission, owned by the group that can read kernel memory devices such as /dev/drum, /dev/kmem, /dev/ksyms, /dev/mem, /dev/swap. ACLs may be another mechanism (e.g., under AIX or Solaris 8) you can use to grant read permission to the kernel memory devices.

- AIX 4.1.[45], 4.2[.1], and 4.3[.123]
- Apple Darwin 7.x for Power Macintosh systems
- DEC OSF/1, Digital UNIX, Tru64 UNIX 2.0, 3.2, 4.0, and 5.[01]
- FreeBSD 2.1.6, 2.2[.x], 3.x, 4.x, 5.x and [67].x
- /dev/kmem-based 11.00
- NetBSD 1.[456], 2.x and 3.x
- NEXTSTEP 3.[13]
- OpenBSD 2.[89] and 3.[0-9]
- OPENSTEP 4.x
- Caldera OpenUNIX 8
- SCO OpenServer 5.0.[46]
- SCO UnixWare 7.0 and 7.1.[0134]
- Solaris 2.6, 8, 9 and 10
- Ultrix 4.2 (no longer available)

=====

Porting Lsof 4 to a New UNIX Dialect

=====

If you're brave enough to consider this, look at the 00PORTING file. Please contact me before you start. I might be able to help you or even do the port myself.

Don't overlook the contrib/ directory in pub/tools/unix/lsof on my ftp server, lsof.itap.purdue.edu. It contains user-contributed ports of lsof to dialects I don't distribute, because I can't test new revisions of lsof on them.

=====

Quick Start to Using Lsof

=====

For information on how to get started quickly using lsof, consult the 00QUICKSTART file of the lsof distribution. It cuts past the formal density of the lsof man page to provide quick examples of using lsof to solve common open file display problems.

=====
Cross-configuring Lsof
=====

Using environment variables it is possible to Configure (and possibly build) Lsof for one UNIX dialect on a different one -- e.g., you are running Configure on a Linux 2.3 system and you want to Configure and build Lsof for Linux 2.4.

See the 00XCONFIG file of the Lsof distribution for a discussion of how to do this.

=====
Environment Variables Affecting the Configure Script
=====

Configure script actions can be modified by introducing values to the script via environment variables. In many cases the environment variable values take the place of test operations the Configure script makes.

For more information on environment variables that can affect Configure, consult the 00XCONFIG file of the Lsof distribution. See the General Environment Variables sections for descriptions of ones that affect all dialects. Consult the Dialect-Specific Environment Variables section for ones that might affect the dialect you are trying to configure.

Vic Abell <abe@purdue.edu>
April 24, 2007

Found in path(s):

* /opt/cola/permits/1550988360_1675319900.3624527/0/lsof-4-85-zip/00README

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

/*

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*

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*

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Found in path(s):

* /opt/cola/permits/1550988360_1675319900.3624527/0/Is0f-4-85-zip/dialects/darwin/libproc/dproc.c

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- */

Found in path(s):

- * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dfile.c
 - * /opt/cola/permits/1550988360_1675319900.3624527/0/Isf-4-85-zip/dialects/darwin/libproc/dlsof.h
- No license file was found, but licenses were detected in source scan.

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* /opt/cola/permits/1550988360_1675319900.3624527/0/Isot-4-85-zip/dialects/du/ddev.c

1.177 lua 5.1.5

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1.178 @tensorflow-models/body-pix 2.2

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```
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.min.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.esm.js
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- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/util_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/util_test.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.d.ts
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.js
- * /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.d.ts

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* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/decode_single_pose.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/keypoints.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/run_tests.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-

pix/dist/single_person/decode_single_pose.js

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```
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/saved_models.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/saved_models.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/index.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/resnet.d.ts
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/index.js
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-
pix/dist/resnet.js
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```
{"version":3,"file":"body-
pix.min.js","sources":["../src/decode_part_map.ts","../src/base_model.ts","../src/mobilenet.ts","../src/keypoints.ts","..
../src/multi_person/util.ts","../src/multi_person/decode_multiple_masks_cpu.ts","../src/multi_person/decode_multiple
_masks_webgl.ts","../src/multi_person/decode_instance_masks.ts","../src/multi_person/max_heap.ts","../src/multi_p
erson/build_part_with_score_queue.ts","../src/multi_person/decode_pose.ts","../src/multi_person/decode_multiple_p
oses.ts","../src/resnet.ts","../src/saved_models.ts","../src/util.ts","../src/body_pix_model.ts","../src/output_rendering_
util.ts","../src/blur.ts","../src/part_channels.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright
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```



```

./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel interface. New base models that conform
to the BaseModel interface can be added to BodyPix.

export abstract class BaseModel {
  constructor(
    protected readonly model: tfconv.GraphModel,
    public readonly outputStride: BodyPixOutputStride) {
    const inputShape =
      this.model.inputs[0].shape as [number, number, number, number];
    tf.util.assert(
      (inputShape[1] === -1) && (inputShape[2] === -1),
      () => `Input shape [${inputShape[1]}, ${inputShape[2]}]
      must both be equal to or -1`);
  }

  abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;

  /**
   * Predicts intermediate Tensor representations.
   * @param input The input RGB image of the base
   model.
   * A Tensor of shape: [inputResolution, inputResolution, 3].
   * @return A dictionary of base
   model's intermediate predictions.
   * The returned dictionary should contains the following elements:
   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.
   * - offsets: A Tensor3D that represents
   the offsets.
   * - displacementFwd: A Tensor3D that represents the forward displacement.
   * - displacementBwd: A Tensor3D that represents the backward displacement.
   * - segmentation: A Tensor3D that
   represents the segmentation of all
   * people.
   * - longOffsets: A Tensor3D that represents the long offsets used
   for
   * instance grouping.
   * - partHeatmaps: A Tensor3D that represents the body part segmentation.

  predict(input: tf.Tensor3D): {
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd:
    tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
    segmentation: tf.Tensor3D,
    partHeatmaps: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    partOffsets: tf.Tensor3D
  }

  return tf.tidy(() => {
    const asFloat =
    this.preprocessInput(tf.cast(input, 'float32'));
    const asBatch = tf.expandDims(asFloat, 0);
    const results =
    this.model.predict(asBatch) as tf.Tensor4D[];
    const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y,
    [0]));
    const namedResults = this.nameOutputResults(results3d);

    return {
      heatmapScores:
      tf.sigmoid(namedResults.heatmap),
      offsets: namedResults.offsets,
      displacementFwd:
      namedResults.displacementFwd,
      displacementBwd: namedResults.displacementBwd,
      segmentation:
      namedResults.segmentation,
      partHeatmaps: namedResults.partHeatmaps,
      longOffsets:
      namedResults.longOffsets,
      partOffsets: namedResults.partOffsets
    };
  });
}

// Because
MobileNet and ResNet predict() methods output a different order for
// these values, we have a method that needs
to be implemented to order them.
abstract nameOutputResults(results: tf.Tensor3D[]): {
  heatmap:
  tf.Tensor3D,
  offsets: tf.Tensor3D,
  displacementFwd: tf.Tensor3D,
  displacementBwd: tf.Tensor3D,
  segmentation: tf.Tensor3D,
  partHeatmaps: tf.Tensor3D,
  longOffsets: tf.Tensor3D,
  partOffsets:
  tf.Tensor3D
};

/**
 * Releases the CPU and GPU memory allocated by the model.
 */
dispose() {
  this.model.dispose();
}

}

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 */
}

=====

import * as tf from '@tensorflow/tfjs-core';
import { BaseModel } from './base_model';

export class
MobileNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    // Normalize the pixels
    [0, 255] to be between [-1, 1].
    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));
  }

  nameOutputResults(results: tf.Tensor3D[]) {
    const [
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmap,
      displacementFwd,
      displacementBwd,
      partOffsets,
    ] = results;

    return {
      offsets,
      segmentation,
      partHeatmaps,
      longOffsets,
      heatmap,
      displacementFwd,
      displacementBwd,
      partOffsets
    };
  }
}

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```
=====
*/\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple = Tuple<number>;\nexport const PART_NAMES = [\n 'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',\n 'leftShoulder',\n 'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n 'leftHip', 'rightHip', 'leftKnee',\n 'rightKnee', 'leftAnkle', 'rightAnkle'];\nexport const NUM_KEYPOINTS = PART_NAMES.length;\nexport interface NumberDict {\n [jointName: string]: number;\n}\nexport const PART_IDS =\n PART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n result[jointName] = i;\n return result;\n }, {});\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n ['leftHip', 'leftShoulder'],\n ['leftElbow', 'leftShoulder'],\n ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],\n ['leftKnee', 'leftAnkle'], ['rightHip',\n 'rightShoulder'],\n ['rightElbow', 'rightShoulder'], ['rightElbow', 'rightWrist'],\n ['rightHip', 'rightKnee'],\n ['rightKnee', 'rightAnkle'],\n ['leftShoulder', 'rightShoulder'], ['leftHip', 'rightHip']];\n\n/* Define the skeleton. This defines the parent->child relationships of our tree. Arbitrarily this defines the nose as the root of the tree, however since we will infer the displacement for both parent->child and child->parent, we can define the tree root as any node.*/\nexport const POSE_CHAIN: StringTuple[] = [\n ['nose', 'leftEye'], ['leftEye', 'leftEar'],\n ['nose', 'rightEye'],\n ['rightEye', 'rightEar'],\n ['nose', 'leftShoulder'],\n ['leftShoulder', 'leftElbow'],\n ['leftElbow', 'leftWrist'],\n ['leftShoulder', 'leftHip'],\n ['leftHip', 'leftKnee'],\n ['leftKnee', 'leftAnkle'],\n ['nose', 'rightShoulder'],\n ['rightShoulder', 'rightElbow'],\n ['rightElbow', 'rightWrist'],\n ['rightShoulder', 'rightHip'],\n ['rightHip', 'rightKnee'],\n ['rightKnee', 'rightAnkle'];\n\nexport const CONNECTED_PART_INDICES =\n CONNECTED_PART_NAMES.map(\n ([jointNameA, jointNameB]) =>\n ([PART_IDS[jointNameA],\n PART_IDS[jointNameB]]);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====
```

```
*/\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from './types';\nexport function getScale(\n [height, width]: [number, number],\n [inputResolutionY, inputResolutionX]: [number, number],\n padding: Padding): [number, number] {\n const {top: padT, bottom: padB, left: padL, right: padR} = padding;\n const scaleY = inputResolutionY / (padT + padB + height);\n const scaleX = inputResolutionX / (padL + padR + width);\n return [scaleX, scaleY];\n}\n\nexport function getOffsetPoint(\n y: number, x: number, keypoint: number, offsets: TensorBuffer3D): Vector2D {\n return {\n y: offsets.get(y, x, keypoint),\n x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)\n };\n}\n\nexport function getImageCoords(\n part: Part, outputStride: number, offsets: TensorBuffer3D): Vector2D {\n const {heatmapY, heatmapX, id: keypoint} = part;\n const {y, x} = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n return {\n x: part.heatmapX * outputStride + x,\n y: part.heatmapY * outputStride + y\n };\n}\n\nexport function fillArray<T>(element: T, size: number): T[] {\n const result: T[] = new Array(size);\n for (let i = 0; i < size; i++) {\n result[i] = element;\n }\n return result;\n}\n\nexport function clamp(a: number, min: number, max: number): number {\n if (a < min) {\n return min;\n }\n if (a > max) {\n return max;\n }\n return a;\n}\n\nexport function squaredDistance(\n y1: number, x1: number, y2: number, x2: number): number {\n const dy = y2 - y1;\n const dx = x2 - x1;\n return dy * dy + dx * dx;\n}\n\nexport function addVectors(a: Vector2D, b: Vector2D): Vector2D {\n return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a: Vector2D, min: number, max: number): Vector2D {\n return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
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```
=====
*/
import {NUM_KEYPOINTS} from './keypoints';
import {Padding, Pose} from './types';
import {getScale} from './util';
interface Pair {
  x: number;
  y: number;
}
function computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {
  let distance = 0.0;
  let numKpt = 0;
  for (let p = 0; p < embedding.length; p++) {
    if (pose.keypoints[p].score > minPartScore) {
      numKpt += 1;
      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 + (embedding[p].y - pose.keypoints[p].position.y) ** 2;
    }
  }
  if (numKpt === 0) {
    distance = Infinity;
  } else {
    distance = distance / numKpt;
  }
  return distance;
}
function convertToPositionInOutput(position: Pair, [padT, padL]: [number, number], [scaleX, scaleY]: [number, number], stride: number): Pair {
  const y = Math.round(((padT + position.y + 1.0) * scaleY - 1.0) / stride);
  const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);
  return {x, y};
}
function getEmbedding(location: Pair, keypointIndex: number, convertToPosition: (pair: Pair) => Pair, outputResolutionX: number, longOffsets: Float32Array, refineSteps: number, [height, width]: [number, number]): Pair {
  const newLocation = convertToPosition(location);
  const nn = newLocation.y * outputResolutionX + newLocation.x;
  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];
  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];
  let y = location.y + dy;
  let x = location.x + dx;
  for (let t = 0; t < refineSteps; t++) {
    y = Math.min(y, height - 1);
    x = Math.min(x, width - 1);
    const newPos = convertToPosition({x, y});
    const nn = newPos.y * outputResolutionX + newPos.x;
    dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];
    dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];
    y = y + dy;
    x = x + dx;
  }
  return {x, y};
}
function matchEmbeddingToInstance(location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number, [padT, padL]: [number, number], [scaleX, scaleY]: [number, number], outputResolutionX: number, [height, width]: [number, number], stride: number, refineSteps: number): number {
  const embed: Pair[] = [];
  const convertToPosition = (pair: Pair) => convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY], stride);
  for (let keypointsIndex = 0; keypointsIndex < numKptForMatching; keypointsIndex++) {
    const embedding = getEmbedding(location, keypointsIndex, convertToPosition, outputResolutionX, longOffsets, refineSteps, [height, width]);
    embed.push(embedding);
  }
  let kMin = -1;
  let kMinDist = Infinity;
  for (let k = 0; k < poses.length; k++) {
    const dist = computeDistance(embed, poses[k]);
    if (dist < kMinDist) {
      kMin = k;
      kMinDist = dist;
    }
  }
  return kMin;
}
function getOutputResolution([inputResolutionY, inputResolutionX]: [number, number], stride: number): [number, number] {
  const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);
  const outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);
  return [outputResolutionX, outputResolutionY];
}
export function decodeMultipleMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, posesAboveScore: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, refineSteps: number, numKptForMatching = 5): Uint8Array[] {
  const dataArrays = posesAboveScore.map(x => new Uint8Array(height * width).fill(0));
  const {top: padT, left: padL} = padding;
  const [scaleX, scaleY] = getScale([height, width], [inHeight, inWidth], padding);
  const [outputResolutionX, ] = getOutputResolution([inHeight, inWidth], stride);
  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const n = i * width + j;
      const prob = segmentation[n];
      if (prob === 1) {
        const kMin = matchEmbeddingToInstance({x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching, [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width], stride, refineSteps);
        if (kMin >= 0) {
          dataArrays[kMin][n] = 1;
        }
      }
    }
  }
  return dataArrays;
}
export function decodeMultiplePartMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, partSegmentaion: Uint8Array, posesAboveScore: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, refineSteps: number,
```

```

numKptForMatching = 5): Int32Array[] {\n  const dataArrays =\n    posesAboveScore.map(x => new
Int32Array(height * width).fill(-1));\n  const {top: padT, left: padL} = padding;\n  const [scaleX, scaleY] =\n    getScale([height, width], [inHeight, inWidth], padding);\n  const [outputResolutionX, ] =\n    getOutputResolution([inHeight, inWidth], stride);\n  for (let i = 0; i < height; i += 1) {\n    for (let j = 0; j < width; j
+= 1) {\n      const n = i * width + j;\n      const prob = segmentation[n];\n      if (prob === 1) {\n        const kMin =
matchEmbeddingToInstance(\n          {x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,\n        [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],\n          stride, refineSteps);\n        if (kMin >=
0) {\n          dataArrays[kMin][n] = partSegmentaion[n];\n        }\n      }\n    }\n  }\n  return
dataArrays;\n}\n",/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====

```

```

*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from '@tensorflow/tfjs-backend-
webgl';\nimport {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Pose} from '../types';\nimport
{getScale} from './util';\n\nexport function decodeMultipleMasksWebGl(\n  segmentation: tf.Tensor2D,\n  longOffsets: tf.Tensor3D,\n  posesAboveScore: Pose[], height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number], padding: Padding,\n  refineSteps: number, minKptScore: number,\n  maxNumPeople: number): tf.TensorInfo {\n  // The height/width of the image/canvas itself.\n  const [origHeight,
origWidth] = segmentation.shape;\n  // The height/width of the output of the model.\n  const [outHeight, outWidth]
= longOffsets.shape.slice(0, 2);\n  const shapedLongOffsets: tf.Tensor4D =\n    tf.reshape(longOffsets,\n  [outHeight, outWidth, 2, NUM_KEYPOINTS]);\n  // Make pose tensor of shape [MAX_NUM_PEOPLE,\n  NUM_KEYPOINTS, 3] where\n  // the last 3 coordinates correspond to the score, h and w coordinate of that\n  //
keypoint.\n  const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n  for (let i =
0; i < posesAboveScore.length; i++) {\n    const poseOffset = i * NUM_KEYPOINTS * 3;\n    const pose =
posesAboveScore[i];\n    for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n      const keypoint =
pose.keypoints[kp];\n      const offset = poseOffset + kp * 3;\n      poseVals[offset] = keypoint.score;\n
      poseVals[offset + 1] = keypoint.position.y;\n      poseVals[offset + 2] = keypoint.position.x;\n    }\n  }\n  const
[scaleX, scaleY] =\n    getScale([height, width], [inHeight, inWidth], padding);\n  const posesTensor =
tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n  const {top: padT, left: padL} = padding;\n  const
program: tf_webgl.GPGPUProgram = {\n    variableNames: ['segmentation', 'longOffsets', 'poses'],\n    outputShape: [origHeight, origWidth],\n    userCode: `\n    int convertToPositionInOut(int pos, int pad, float
scale, int stride) {\n      return round(((float(pos + pad) + 1.0) * scale - 1.0) / float(stride));\n    }\n\n    float
convertToPositionInOutFloat(\n      int pos, int pad, float scale, int stride) {\n      return ((float(pos + pad) + 1.0)
* scale - 1.0) / float(stride);\n    }\n\n    float dist(float x1, float y1, float x2, float y2) {\n      return pow(x1 - x2, 2.0)
+ pow(y1 - y2, 2.0);\n    }\n\n    float sampleLongOffsets(float h, float w, int d, int k) {\n      float fh = fract(h);\n
float fw = fract(w);\n      int clH = int(ceil(h));\n      int clW = int(ceil(w));\n      int flH = int(floor(h));\n      int flW =
int(floor(w));\n      float o11 = getLongOffsets(flH, flW, d, k);\n      float o12 = getLongOffsets(flH, clW, d, k);\n
float o21 = getLongOffsets(clH, flW, d, k);\n      float o22 = getLongOffsets(clH, clW, d, k);\n      float o1 =
mix(o11, o12, fw);\n      float o2 = mix(o21, o22, fw);\n      return mix(o1, o2, fh);\n    }\n\n    int
findNearestPose(int h, int w) {\n      float prob = getSegmentation(h, w);\n      if (prob < 1.0) {\n        return -1;\n
      }\n\n      // Done(Tyler): convert from output space h/w to strided space.\n      float stridedH =
convertToPositionInOutFloat(\n        h, ${padT}, ${scaleY}, ${stride});\n      float stridedW =
convertToPositionInOutFloat(\n        w, ${padL}, ${scaleX}, ${stride});\n\n      float minDist = 1000000.0;\n      int iMin = -1;\n      for (int i = 0; i < ${maxNumPeople}; i++) {\n        float curDistSum = 0.0;\n        int numKpt =

```



```

partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n  stride: number, [inHeight,
inWidth]: [number, number], padding: Padding,\n  minPoseScore = 0.2, refineSteps = 8, minKeypointScore =
0.3,\n  maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n  let partSegmentationsByPersonData: Int32Array[];\n  if (isWebGLBackend())
{\n  const partSegmentations = tf.tidy(() => {\n  const masksTensorInfo = decodeMultipleMasksWebGL(\n
segmentation, longOffsets, posesAboveScore, height, width, stride,\n    [inHeight, inWidth], padding,
refineSteps, minKeypointScore,\n    maxNumPeople);\n  const masksTensor =
tf.engine().makeTensorFromDataId(\n    masksTensorInfo.dataId, masksTensorInfo.shape,\n
masksTensorInfo.dtype) as tf.Tensor2D;\n\n  return posesAboveScore.map(\n    (_, k) =>\n
toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n  });\n  partSegmentationsByPersonData =\n    (await Promise.all(partSegmentations.map(x => x.data()))) as\n    Int32Array[];\n\n  partSegmentations.forEach(x => x.dispose());\n  } else {\n  const segmentationsData = await segmentation.data()
as Uint8Array;\n  const longOffsetsData = await longOffsets.data() as Float32Array;\n  const
partSegmentaionData = await partSegmentation.data() as Uint8Array;\n  partSegmentationsByPersonData =
decodeMultiplePartMasksCPU(\n    segmentationsData, longOffsetsData, partSegmentaionData,\n
posesAboveScore, height, width, stride, [inHeight, inWidth], padding,\n    refineSteps);\n  }\n  return
partSegmentationsByPersonData.map(\n    (data, k) => ({pose: posesAboveScore[k], data, height,
width}));\n  }\n  }"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the
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License.\n *

```

```

=====\n
*/\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n\n//
https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n  return
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n  private priorityQueue: T[];\n  private numberOfElements:
number;\n  private getElementValue: (element: T) => number;\n\n  constructor(maxSize: number, getElementValue:
(element: T) => number) {\n    this.priorityQueue = new Array(maxSize);\n    this.numberOfElements = -1;\n\n
this.getElementValue = getElementValue;\n  }\n\n  public enqueue(x: T): void {\n\n    this.priorityQueue[++this.numberOfElements] = x;\n    this.swim(this.numberOfElements);\n  }\n\n  public
dequeue(): T {\n    const max = this.priorityQueue[0];\n    this.exchange(0, this.numberOfElements--);\n\n    this.sink(0);\n    this.priorityQueue[this.numberOfElements + 1] = null;\n    return max;\n  }\n\n  public empty():
boolean {\n    return this.numberOfElements === -1;\n  }\n\n  public size(): number {\n    return
this.numberOfElements + 1;\n  }\n\n  public all(): T[] {\n    return this.priorityQueue.slice(0, this.numberOfElements
+ 1);\n  }\n\n  public max(): T {\n    return this.priorityQueue[0];\n  }\n\n  private swim(k: number): void {\n    while
(k > 0 && this.less(half(k), k)) {\n      this.exchange(k, half(k));\n      k = half(k);\n    }\n  }\n\n  private sink(k:
number): void {\n    while (2 * k <= this.numberOfElements) {\n      let j = 2 * k;\n      if (j < this.numberOfElements
&& this.less(j, j + 1)) {\n        j++;\n      }\n      if (!this.less(k, j)) {\n        break;\n      }\n      this.exchange(k, j);\n      k = j;\n    }\n  }\n\n  private getValueAt(i: number): number {\n    return
this.getElementValue(this.priorityQueue[i]);\n  }\n\n  private less(i: number, j: number): boolean {\n    return
this.getValueAt(i) < this.getValueAt(j);\n  }\n\n  private exchange(i: number, j: number): void {\n    const t =
this.priorityQueue[i];\n    this.priorityQueue[i] = this.priorityQueue[j];\n    this.priorityQueue[j] = t;\n  }\n  }"/**\n
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```
=====
*\n\nimport {PartWithScore, TensorBuffer3D} from '../types';\n\nimport {MaxHeap} from
'./max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n  keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n  localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n  const
[height, width] = scores.shape;\n\n  let localMaximum = true;\n  const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n  for (let
yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n    const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n    const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n    for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n      if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n        localMaximum
= false;\n        break;\n      }\n    }\n    if (!localMaximum) {\n      break;\n    }\n  }\n  return
localMaximum;\n}\n\n/**\n * Builds a priority queue with part candidate positions for a specific image in\n * the
batch. For this we find all local maxima in the score maps with score\n * values above a threshold. We create a
single priority queue across all parts.\n */\n\nexport function buildPartWithScoreQueue(\n  scoreThreshold: number,
localMaximumRadius: number,\n  scores: TensorBuffer3D): MaxHeap<PartWithScore> {\n  const [height, width,
numKeypoints] = scores.shape;\n\n  const queue = new MaxHeap<PartWithScore>(\n    height * width *
numKeypoints, ({score}) => score);\n\n  for (let heatmapY = 0; heatmapY < height; ++heatmapY) {\n    for (let
heatmapX = 0; heatmapX < width; ++heatmapX) {\n      for (let keypointId = 0; keypointId < numKeypoints;
++keypointId) {\n        const score = scores.get(heatmapY, heatmapX, keypointId);\n\n        // Only consider parts
with score greater or equal to threshold as\n        // root candidates.\n        if (score < scoreThreshold) {\n
continue;\n        }\n\n        // Only consider keypoints whose score is maximum in a local window.\n        if
(scoreIsMaximumInLocalWindow(\n          keypointId, score, heatmapY, heatmapX, localMaximumRadius,\n          scores)) {\n          queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});\n        }\n      }\n    }\n  }\n  return queue;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
```

```
*\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from '../keypoints';\n\nimport {Keypoint,
PartWithScore, TensorBuffer3D, Vector2D} from '../types';\n\nimport {clamp, getOffsetPoint} from './util';\n\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n  ([parentJoinName, childJoinName]): NumberTuple =>\n  ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\n  parentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\n  parentChildrenTuples.map(([\n    parentJointId,\n    parentJointId]) =>\n  parentJointId);\n\nfunction getDisplacement(\n  edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n  const numEdges = displacements.shape[2] / 2;\n  return {\n    y:
displacements.get(point.y, point.x, edgeId),\n    x: displacements.get(point.y, point.x, numEdges + edgeId)\n  };\n}\n\nfunction getStridedIndexNearPoint(\n  point: Vector2D, outputStride: number, height: number,\n  width:
number): Vector2D {\n  return {\n    y: clamp(Math.round(point.y / outputStride), 0, height - 1),\n    x:
clamp(Math.round(point.x / outputStride), 0, width - 1)\n  };\n}\n\n/**\n * We get a new keypoint along the
`edgeId` for the pose instance, assuming\n * that the position of the `idSource` part is already known. For this, we\n
* follow the displacement vector from the source to target part (stored in\n * the `i`-t channel of the displacement
tensor). The displaced keypoint\n * vector is refined using the offset vector by `offsetRefineStep` times.\n */
```



```

scores of the parts that overlap with any previously detected
 * instance.\n */\nfunction getInstanceScore(\n
existingPoses: Pose[], squaredNmsRadius: number,\n
instanceKeypoints: Keypoint[]): number {\n
let\n
notOverlappedKeypointScores = instanceKeypoints.reduce(\n
(result, { position, score }, keypointId): number =>
{\n
if (!withinNmsRadiusOfCorrespondingPoint(\n
existingPoses, squaredNmsRadius, position,\n
keypointId)) {\n
result += score;\n
}\n
return result;\n
}, 0.0);\n
return\n
notOverlappedKeypointScores /= instanceKeypoints.length;\n
}\n\n// A point (y, x) is considered as root part
candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n//
kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts
from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in
decreasing root score order. It works as follows: We first\n * create a priority queue with local part score maxima
above\n * `scoreThreshold`, considering all parts at the same time. Then we\n * iteratively pull the top element of
the queue (in decreasing score order)\n * and treat it as a root candidate for a new object instance. To avoid\n *
duplicate detections, we reject the root candidate if it is within a disk\n * of `nmsRadius` pixels from the
corresponding part of a previously detected\n * instance, which is a form of part-based non-maximum suppression
(NMS). If\n * the root candidate passes the NMS check, we start a new object instance\n * detection, treating the
corresponding part as root and finding the\n * positions of the remaining parts by following the displacement
vectors\n * along the tree-structured part graph. We assign to the newly detected\n * instance a score equal to the
sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at least `nmsRadius`\n
* pixels away from the corresponding part of all previously detected\n * instances), divided by the total number of
parts `numParts`.\n *\n * @param heatmapScores 3-D tensor with shape `[height, width, numParts]`.\n * The value
of heatmapScores[y, x, k] is the score of placing the `k`-th\n * object part at position `(y, x)`.\n *\n * @param
offsets 3-D tensor with shape `[height, width, numParts * 2]`.\n * The value of [offsets[y, x, k], offsets[y, x, k +
numParts]] is the\n * short range offset vector of the `k`-th object part at heatmap\n * position `(y, x)`.\n *\n *
@param displacementsFwd 3-D tensor of shape\n * `[height, width, 2 * num_edges]`, where `num_edges =
num_parts - 1` is the\n * number of edges (parent-child pairs) in the tree. It contains the forward\n * displacements
between consecutive part from the root towards the leaves.\n *\n * @param displacementsBwd 3-D tensor of
shape\n * `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is the\n * number of edges (parent-
child pairs) in the tree. It contains the backward\n * displacements between consecutive part from the root towards
the leaves.\n *\n * @param outputStride The output stride that was used when feed-forwarding\n * through the
PoseNet model. Must be 32, 16, or 8.\n *\n * @param maxPoseDetections Maximum number of returned instance
detections per\n * image.\n *\n * @param scoreThreshold Only return instance detections that have root part\n *
score greater or equal to this value. Defaults to 0.5.\n *\n * @param nmsRadius Non-maximum suppression part
distance. It needs to be\n * strictly positive. Two parts suppress each other if they are less than\n * `nmsRadius`\n
pixels away. Defaults to 20.\n *\n * @return An array of poses and their scores, each containing keypoints and\n *
the corresponding keypoint scores.\n */\nexport function decodeMultiplePoses(\n
scoresBuffer: TensorBuffer3D,\n
offsetsBuffer: TensorBuffer3D,\n
displacementsFwdBuffer: TensorBuffer3D,\n
displacementsBwdBuffer:\n
TensorBuffer3D, outputStride: number,\n
maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20):
Pose[] {\n
const poses: Pose[] = [];\n
const queue = buildPartWithScoreQueue(\n
scoreThreshold,\n
kLocalMaximumRadius, scoresBuffer);\n
const squaredNmsRadius = nmsRadius * nmsRadius;\n
// Generate\n
at most maxDetections object instances per image in\n
// decreasing root part score order.\n
while (poses.length <
maxPoseDetections && !queue.empty()) {\n
// The top element in the queue is the next root candidate.\n
const\n
root = queue.dequeue();\n
// Part-based non-maximum suppression: We reject a root candidate if it\n
// is\n
within a disk of `nmsRadius` pixels from the corresponding part of\n
// a previously detected instance.\n
const\n
rootImageCoords =\n
getImageCoords(root.part, outputStride, offsetsBuffer);\n
if\n
(withinNmsRadiusOfCorrespondingPoint(\n
poses, squaredNmsRadius, rootImageCoords, root.part.id)) {\n
continue;\n
}\n
// Start a new detection instance at the position of the root.\n
const keypoints =\n
decodePose(\n
root, scoresBuffer, offsetsBuffer, outputStride, displacementsFwdBuffer,\n
displacementsBwdBuffer);\n
const score = getInstanceScore(poses, squaredNmsRadius, keypoints);\n
}

```

poses.push({keypoints, score});\n }\n\n return poses;\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * https://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BaseModel} from './base_model';\nconst imageNetMean = [-123.15, -115.90, -103.06];\nexport class ResNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    return tf.add(input, imageNetMean);\n  }\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      displacementBwd,\n      displacementFwd,\n      heatmap,\n      longOffsets,\n      offsets,\n      partHeatmaps,\n      segmentation,\n      partOffsets,\n    ] = results;\n    return {\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    }; \n  }\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * https://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/resnet50';\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet';\n\n// The BodyPix 2.0 ResNet50 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number, quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return RESNET50_BASE_URL + `float` + graphJson;\n  } else {\n    return RESNET50_BASE_URL + `quant${quantBytes}` + graphJson;\n  }\n}\n\n// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function mobileNetSavedModel(\n  stride: number, multiplier: number, quantBytes: number): string {\n  const toStr: {[key: number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return MOBILENET_BASE_URL + `float/${toStr[multiplier]}` + graphJson;\n  } else {\n    return MOBILENET_BASE_URL + `quant${quantBytes}/${toStr[multiplier]}` +\n      graphJson;\n  }\n}\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BodyPixInput, BodyPixOutputStride, Padding} from './types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from './types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\n  HTMLCanvasElement|\n  OffscreenCanvas): [number, number] {\n  if ('offsetHeight' in input && input.offsetHeight !== 0 && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return [input.offsetHeight, input.offsetWidth];\n  } else if (input.height !== null && input.width !== null) {\n    return
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[input.height, input.width];\n } else {\n   throw new Error(\n     `HTMLImageElement must have height and
width attributes set.`);\n   }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,
number] {\n  if (input.hasAttribute('height') && input.hasAttribute('width')) {\n    // Prioritizes user specified height
and width.\n    // We can't test the .height and .width properties directly,\n    // because they evaluate to 0 if unset.\n    return [input.height, input.width];\n  } else {\n    return [input.videoHeight, input.videoWidth];\n  }\n}\n\nexport
function getInputSize(input: BodyPixInput): [number, number] {\n  if ((typeof (HTMLCanvasElement) !==
'undefined' &&\n    input instanceof HTMLCanvasElement) ||\n    (typeof (OffscreenCanvas) !== 'undefined'
&&\n    input instanceof OffscreenCanvas) ||\n    (typeof (HTMLImageElement) !== 'undefined' &&\n
input instanceof HTMLImageElement)) {\n    return getSizeFromImageLikeElement(input);\n  } else if (typeof
(ImageData) !== 'undefined' && input instanceof ImageData) {\n    return [input.height, input.width];\n  } else if (\n
    typeof (HTMLVideoElement) !== 'undefined' &&\n    input instanceof HTMLVideoElement) {\n    return
getSizeFromVideoElement(input);\n  } else if (input instanceof tf.Tensor) {\n    return [input.shape[0],
input.shape[1]];\n  } else {\n    throw new Error(`error: Unknown input type: ${input}`);\n  }\n}\n\nfunction
isValidInputResolution(\n  resolution: number, outputStride: number): boolean {\n  return (resolution - 1) %
outputStride === 0;\n}\n\nexport function toValidInputResolution(\n  inputResolution: number, outputStride:
BodyPixOutputStride): number {\n  if (isValidInputResolution(inputResolution, outputStride)) {\n    return
inputResolution;\n  }\n\n  return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst
INTERNAL_RESOLUTION_STRING_OPTIONS = {\n  low: 'low',\n  medium: 'medium',\n  high: 'high',\n  full:
'full'\n};\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =
0.1;\n\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n
internalResolution: BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n
const result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n\n    tf.util.assert(\n      typeof result
=== 'number',\n      () => `string value of inputResolution must be one of ${\n
Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n        .join(',')\n      } but was
${internalResolution}`);\n    return result;\n  } else {\n    tf.util.assert(\n      typeof internalResolution
=== 'number'
&&\n      internalResolution <= MAX_INTERNAL_RESOLUTION &&\n      internalResolution >=
MIN_INTERNAL_RESOLUTION,\n      () =>\n        `inputResolution must be a string or number between ${\n
MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION}, but ` +\n        `was
${internalResolution}`);\n    return internalResolution;\n  }\n}\n\nexport function
toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n\n  return [\n
toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n    inputWidth * internalResolutionPercentage, outputStride)\n  ];\n}\n\nexport function
toInputTensor(input: BodyPixInput) {\n  // TODO: tf.browser.fromPixels types to support OffscreenCanvas\n //
@ts-ignore\n  return input instanceof tf.Tensor ? input : tf.browser.fromPixels(input);\n}\n\nexport function
resizeAndPadTo(\n  imageTensor: tf.Tensor3D, [targetH, targetW]: [number, number],\n  flipHorizontal = false):
{\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy: [[number, number], [number, number]]\n} {\n  const [height,
width] = imageTensor.shape;\n\n  const targetAspect = targetW / targetH;\n  const aspect = width / height;\n\n  let
resizeW: number;\n  let resizeH: number;\n  let padL: number;\n  let padR: number;\n  let padT: number;\n  let
padB: number;\n\n  if (aspect > targetAspect) {\n    // resize to have the larger dimension match the shape.\n
resizeW = targetW;\n    resizeH = Math.ceil(resizeW / aspect);\n\n    const padHeight = targetH - resizeH;\n    padL
= 0;\n    padR = 0;\n    padT = Math.floor(padHeight / 2);\n    padB = targetH - (resizeH + padT);\n  } else {\n
resizeH = targetH;\n    resizeW = Math.ceil(targetH * aspect);\n\n    const padWidth = targetW - resizeW;\n    padL

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= Math.floor(padWidth / 2);\n  padR = targetW - (resizeW + padL);\n  padT = 0;\n  padB = 0;\n }\n\n const
resizedAndPadded = tf.tidy(() => {\n  // resize to have largest dimension match image\n  let resized:
tf.Tensor3D;\n  if (flipHorizontal) {\n    resized = tf.image.resizeBilinear(\n      tf.reverse(imageTensor, 1),
[resizeH, resizeW]);\n  } else {\n    resized = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n  }\n\n
const padded = tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);\n\n  return padded;\n });\n\n return
{resizedAndPadded, paddedBy: [[padT, padB], [padL, padR]]};\n }\n\n\nexport function
scaleAndCropToInputTensorShape(\n  tensor: tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number,
number],\n  [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL,
padR]]: [[number, number], [number, number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return
tf.tidy(() => {\n    let inResizedAndPadded: tf.Tensor3D = tf.image.resizeBilinear(tensor,\n
[resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n\n    if (applySigmoidActivation) {\n
inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n    }\n\n    return removePaddingAndResizeBack(\n
inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n      [[padT, padB], [padL, padR]]);\n
  });\n }\n\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded: tf.Tensor3D,\n  [originalHeight,
originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number, number]]):\n
tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D = tf.expandDims(resizedAndPadded);\n
return tf.squeeze(tf.image\n      .cropAndResize(\n        batchedImage, [[\n          padT / (originalHeight +
padT + padB - 1.0),\n          padL / (originalWidth + padL + padR - 1.0),\n          (padT + originalHeight - 1.0)
/\n          (originalHeight + padT + padB - 1.0),\n          (padL + originalWidth - 1.0) / (originalWidth + padL
+ padR - 1.0)\n        ]],\n        [0], [originalHeight, originalWidth], [0]);\n    });\n }\n\n\nexport function resize2d(\n
tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n  return
tf.tidy(() => {\n    const batchedImage: tf.Tensor4D = tf.expandDims(tensor, 2);\n    return tf.squeeze(\n
tf.image.resizeBilinear(batchedImage, resolution, nearestNeighbor));\n  });\n }\n\n\nexport function
padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]: [number, number]):\n  {resized: tf.Tensor3D,
padding: Padding} {\n  const [height, width] = getInputSize(input);\n  const targetAspect = targetW / targetH;\n
const aspect = width / height;\n  let [padT, padB, padL, padR] = [0, 0, 0, 0];\n  if (aspect < targetAspect) {\n
// pads the width\n  padT = 0;\n  padB = 0;\n  padL = Math.round(0.5 * (targetAspect * height - width));\n  padR
= Math.round(0.5 * (targetAspect * height - width));\n  } else {\n  // pads the height\n  padT = Math.round(0.5 *
((1.0 / targetAspect) * width - height));\n  padB = Math.round(0.5 * ((1.0 / targetAspect) * width - height));\n
padL = 0;\n  padR = 0;\n  }\n\n  const resized: tf.Tensor3D = tf.tidy(() => {\n    let imageTensor =
toInputTensor(input);\n    imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n\n    return
tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n  });\n\n  return {resized, padding: {top: padT, left: padL,
right: padR, bottom: padB}};\n }\n\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\nPromise<TensorBuffer3D[]> {\n  return Promise.all(tensors.map(tensor => tensor.buffer()));\n }\n\n\nexport function
scalePose(\n  pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n  offsetX = 0): Pose {\n  return {\n    score: pose.score,\n    keypoints: pose.keypoints.map(({score, part, position}) => ({\n
score,\n      part,\n      position: {\n        x: position.x * scaleX +
offsetX,\n        y: position.y * scaleY + offsetY\n      }\n    })))\n  };\n }\n\n\nexport function scalePoses(\n  poses: Pose[],
scaleY: number, scaleX: number, offsetY = 0, offsetX
= 0) {\n  if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0) {\n    return poses;\n  }\n  return
poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n }\n\n\nexport function
flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n  return {\n    score: pose.score,\n    keypoints:
pose.keypoints.map(\n      ({score, part, position}) => ({\n        score,\n        part,\n        position: {x:
imageWidth - 1 - position.x, y: position.y}\n      })\n    );\n  }\n }\n\n\nexport function flipPosesHorizontal(poses: Pose[],
imageWidth: number) {\n  if (imageWidth <= 0) {\n    return poses;\n  }\n  return poses.map(pose =>
flipPoseHorizontal(pose, imageWidth));\n }\n\n\nexport function scaleAndFlipPoses(\n  poses: Pose[], [height,
width]: [number, number],\n  [inputResolutionHeight, inputResolutionWidth]: [number, number],\n  padding:
Padding, flipHorizontal: boolean): Pose[] {\n  const scaleY =\n    (height + padding.top + padding.bottom) /

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(inputResolutionHeight);\n const scaleX =\n (width + padding.left + padding.right) /
(inputResolutionWidth);\n\n const scaledPoses =\n scalePoses(poses, scaleY, scaleX, -padding.top, -
padding.left);\n\n if (flipHorizontal) {\n return flipPosesHorizontal(scaledPoses, width);\n } else {\n return
scaledPoses;\n }\n}\n", "\n**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport
{ BaseModel } from './base_model';\nimport { decodeOnlyPartSegmentation, decodePartSegmentation,
toMaskTensor } from './decode_part_map';\nimport { MobileNet } from './mobilenet';\nimport
{ decodePersonInstanceMasks, decodePersonInstancePartMasks } from
'/multi_person/decode_instance_masks';\nimport { decodeMultiplePoses } from
'/multi_person/decode_multiple_poses';\nimport { ResNet } from './resnet';\nimport { mobileNetSavedModel,
resNet50SavedModel } from './saved_models';\nimport { BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding } from
'/types';\nimport { PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation } from './types';\nimport { getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D }
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n**\n * BodyPix model loading is configurable using the following config dictionary.\n *\n *
`architecture`: BodyPixArchitecture. It determines which BodyPix architecture\n * to load. The supported
architectures are: MobileNetV1 and ResNet50.\n *\n * `outputStride`: Specifies the output stride of the BodyPix
model.\n * The smaller the value, the larger the output resolution, and more accurate\n * the model at the cost of
speed. Set this to a larger value to increase speed\n * at the cost of accuracy. Stride 32 is supported for ResNet and\n
* stride 8,16,32 are supported for various MobileNetV1 models.\n *\n * `multiplier`: An optional number with
values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by MobileNet architecture. It is the float\n *
multiplier for the depth (number of channels) for all convolution ops.\n * The larger the value, the larger the size of the layers, and
more accurate\n * the model at the cost of speed. Set this to a smaller value to increase speed\n * at the cost of
accuracy.\n *\n * `modelUrl`: An optional string that specifies custom url of the model. This\n * is useful for
area/countries that don't have access to the model hosted on\n * GCP.\n *\n * `quantBytes`: An optional number
with values: 1, 2, or 4. This parameter\n * affects weight quantization in the models. The available options are\n * 1
byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size\n * and thus the longer the loading time,
the lower the value, the shorter the\n * loading time but lower the accuracy.\n */\n\nexport interface ModelConfig {\n
architecture: BodyPixArchitecture;\n outputStride: BodyPixOutputStride;\n multiplier?: BodyPixMultiplier;\n
modelUrl?: string;\n quantBytes?: BodyPixQuantBytes;\n}\n\n// The default configuration for loading
MobileNetV1 based BodyPix.\n// (And for references, the default configuration for loading ResNet\n// based
PoseNet is also included).\n// ``\n// const RESNET_CONFIG = {\n// architecture: 'ResNet50',\n//
outputStride: 32,\n// quantBytes: 4,\n// } as ModelConfig;\n// ``\n\nconst MOBILENET_V1_CONFIG = {\n
architecture: 'MobileNetV1',\n outputStride: 16,\n quantBytes: 4,\n multiplier: 0.75,\n} as ModelConfig;\n\nconst
VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id:
string]: BodyPixOutputStride[]} = {\n 'MobileNetV1': [8, 16, 32],\n 'ResNet50': [32, 16]\n};\nconst
VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n 'MobileNetV1': [0.50, 0.75, 1.0],\n 'ResNet50':
[1.0]\n};\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction
validateModelConfig(config: ModelConfig): ModelConfig {\n config = config || MOBILENET_V1_CONFIG;\n
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if (config.architecture == null) {\n  config.architecture = 'MobileNetV1';\n }\n if
(VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n  throw new Error(\n    `Invalid architecture
${config.architecture}. ` +\n    `Should be one of ${VALID_ARCHITECTURE}`);\n }\n if (config.outputStride
== null) {\n  config.outputStride = 16;\n }\n if
(VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {\n  throw new Error(\n    `Invalid
outputStride ${config.outputStride}. ` +\n    `Should be one of ${VALID_STRIDE[config.architecture]} ` +\n
`for architecture ${config.architecture}.`);\n }\n\n if (config.multiplier == null) {\n  config.multiplier = 1.0;\n }\n
if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n  throw new Error(\n
`Invalid multiplier ${config.multiplier}. ` +\n    `Should be one of
${VALID_MULTIPLIER[config.architecture]} ` +\n    `for architecture ${config.architecture}.`);\n }\n\n if
(config.quantBytes == null) {\n  config.quantBytes = 4;\n }\n if
(VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n  throw new Error(\n    `Invalid quantBytes
${config.quantBytes}. ` +\n    `Should be one of ${VALID_QUANT_BYTES} ` +\n    `for architecture
${config.architecture}.`);\n }\n\n return config;\n}\n\n/**\n * BodyPix inference is configurable using the
following config dictionary.\n *\n * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n *
should be flipped/mirrored horizontally. This should be set to true for\n * videos where the video is by default
flipped horizontally (i.e. a webcam),\n * and you want the person & body part segmentation to be returned in the proper\n
* orientation.\n *\n * `internalResolution`: Defaults to 'medium'. The internal resolution\n * percentage that the
input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of
slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or a\n * percentage value between 0
and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n *\n *
`segmentationThreshold`: The minimum that segmentation values must\n * have to be considered part of the person.
Affects the generation of the\n * segmentation mask. More specifically, it is the threshold used to binarize\n * the
intermediate person segmentation probability. The probability of each\n * pixel belongs to a person is in range [0,
1]. If the probability is greater\n * than the `segmentationThreshold`, it will be set to 1 otherwise 0.\n *\n */\n\nexport
interface InferenceConfig {\n  flipHorizontal?: boolean;\n  internalResolution?: BodyPixInternalResolution;\n
segmentationThreshold?: number;\n}\n\n/**\n * Person Inference Config\n *\n * `maxDetections`: Defaults to 10.
Maximum number of person pose detections per\n * image.\n *\n * `scoreThreshold`: Defaults to 0.4. Only return
person pose that have root\n * part score greater or equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-
maximum suppression part distance in pixels.\n * It needs to be strictly positive. Two pose keypoints suppress each
other if\n * they are less than `nmsRadius` pixels away.\n */\n\nexport interface PersonInferenceConfig extends
InferenceConfig {\n  maxDetections?: number;\n  scoreThreshold?: number;\n  nmsRadius?: number;\n}\n\n/**\n *
Multiple Person Instance Inference Config\n *\n * `maxDetections`: Defaults to 10. Maximum number of returned
instance\n * segmentation and pose detections per image.\n *\n * `scoreThreshold`: Defaults to 0.4. Only returns
and uses person\n * poses for instance segmentation assignment when the pose has root part score\n * greater or
equal to this value.\n *\n * `nmsRadius`: Defaults to 20. Non-maximum suppression part distance in pixels.\n *
It needs to be strictly positive. Two parts suppress each other if they are\n * less than `nmsRadius` pixels away.\n
*\n * `minKeypointScore`: Default to 0.3. Keypoints above the score are used\n * for matching and assigning
segmentation mask to each person.\n *\n * `refineSteps`: Default to 10. The number of refinement steps used when\n
* assigning the instance segmentation. It needs to be strictly positive. The\n * larger the higher the accuracy and
slower the inference.\n *\n */\n\nexport interface MultiPersonInstanceInferenceConfig extends InferenceConfig {\n
maxDetections?: number;\n  scoreThreshold?: number;\n  nmsRadius?: number;\n  minKeypointScore?: number;\n
refineSteps?: number;\n}\n\nexport const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {\n
flipHorizontal: false,\n  internalResolution: 'medium',\n  segmentationThreshold: 0.7,\n  maxDetections: 10,\n
scoreThreshold: 0.4,\n  nmsRadius: 20,\n};\n\nexport const
MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiPersonInstanceInferenceConfig = {\n
flipHorizontal: false,\n  internalResolution: 'medium',\n  segmentationThreshold: 0.7,\n  maxDetections:
10,\n  scoreThreshold: 0.4,\n  nmsRadius: 20,\n  minKeypointScore: 0.3,\n  refineSteps: 10\n}

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};\n\nfunction validatePersonInferenceConfig(config: PersonInferenceConfig) {\n  const {segmentationThreshold,\n    maxDetections, scoreThreshold, nmsRadius} =\n    config;\n  if (segmentationThreshold < 0.0 ||\n    segmentationThreshold > 1.0) {\n    throw new Error(\n      `segmentationThreshold ${segmentationThreshold}.`\n      +\n      `Should be in range [0.0, 1.0]`);\n  }\n  if (maxDetections <= 0) {\n    throw new Error(\n      `Invalid\n    maxDetections ${maxDetections}.`\n      +\n      `Should be > 0`);\n  }\n  if (scoreThreshold < 0.0 || scoreThreshold >\n    1.0) {\n    throw new Error(\n      `Invalid scoreThreshold ${scoreThreshold}.`\n      +\n      `Should be in range [0.0,\n    1.0]`);\n  }\n  if (nmsRadius <= 0) {\n    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n  }\n}\n\nfunction validateMultiPersonInstanceInferenceConfig(\n  config: MultiPersonInstanceInferenceConfig) {\n  const {\n    segmentationThreshold,\n    maxDetections,\n    scoreThreshold,\n    nmsRadius,\n    minKeypointScore,\n    refineSteps\n  } = config;\n  if (segmentationThreshold < 0.0 || segmentationThreshold >\n    1.0) {\n    throw new Error(\n      `segmentationThreshold ${segmentationThreshold}.`\n      +\n      `Should be in\n    range [0.0, 1.0]`);\n  }\n  if (maxDetections <= 0) {\n    throw new Error(\n      `Invalid maxDetections\n    ${maxDetections}.`\n      +\n      `Should be > 0`);\n  }\n  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {\n    throw\n    new Error(\n      `Invalid scoreThreshold ${scoreThreshold}.`\n      +\n      `Should be in range [0.0, 1.0]`);\n  }\n  if\n    (nmsRadius <= 0) {\n    throw new Error(`Invalid nmsRadius ${nmsRadius}.`);\n  }\n  if (minKeypointScore < 0 ||\n    minKeypointScore > 1) {\n    throw new Error(\n      `Invalid minKeypointScore ${minKeypointScore}.`\n      +\n      `Should be in range [0.0, 1.0]`);\n  }\n  if (refineSteps <= 0 || refineSteps > 20) {\n    throw new Error(\n      `Invalid refineSteps ${refineSteps}.`\n      +\n      `Should be in range [1, 20]`);\n  }\n}\n\nexport class BodyPix {\n  baseModel: BaseModel;\n\n  constructor(net: BaseModel) {\n    this.baseModel = net;\n  }\n\n  private\n  predictForPersonSegmentation(input: tf.Tensor3D): {\n    segmentLogits: tf.Tensor3D,\n    heatmapScores:\n    tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n  }\n  {\n    const {\n      segmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    }\n    = this.baseModel.predict(input);\n    return {\n      segmentLogits: segmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    };\n  }\n\n  private\n  predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n    segmentLogits: tf.Tensor3D,\n    partHeatmapLogits: tf.Tensor3D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd:\n    tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n  }\n  {\n    const {\n      segmentation,\n      partHeatmaps,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd\n    }\n    = this.baseModel.predict(input);\n    return {\n      segmentLogits: segmentation,\n      partHeatmapLogits: partHeatmaps,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    };\n  }\n\n  private\n  predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n  {\n    segmentLogits:\n    tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D\n  }\n  {\n    const {\n      segmentation,\n      longOffsets,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      partHeatmaps,\n    }\n    = this.baseModel.predict(input);\n    return {\n      segmentLogits:\n      segmentation,\n      longOffsets,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      partHeatmaps\n    };\n  }\n\n  /**\n   * Given an image with people, returns a dictionary of all intermediate\n   * tensors including: 1) a binary array with 1 for the pixels that are part of\n   * the person, and 0 otherwise, 2)\n   * heatmapScores, 3) offsets, and 4) paddings.\n   *\n   * @param input\n   * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n   * The input image to feed\n   * through the network.\n   *\n   * @param internalResolution Defaults to 'medium'. The internal resolution\n   * that\n   * the input is resized to before inference. The larger the\n   * internalResolution the more accurate the model at the\n   * cost of slower\n   * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n   * a percentage value\n   * between 0 and 1. The values 'low', 'medium', 'high', and\n   * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n   *\n   * @param segmentationThreshold The minimum that segmentation values must have\n   * to be considered\n   * part of the person. Affects the generation of the\n   * segmentation mask.\n   *\n   * @return A dictionary containing\n   * `segmentation`, `heatmapScores`, `offsets`,\n   * and `padding`:\n   * - `segmentation`: A 2d Tensor with 1 for the\n   * pixels that are part of the\n   * person, and 0 otherwise. The width and height correspond to the same\n   *

```

dimensions of the input image.

- * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by pose estimation decoding.
- * - `offsets`: A 3d Tensor of the keypoint offsets used by pose estimation decoding.
- * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.
- * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.
- * - `padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.

```

*
* @param input: BodyPixInput, internalResolution:
* BodyPixInternalResolution, segmentationThreshold = 0.5): {
*   segmentation: tf.Tensor2D,
*   heatmapScores: tf.Tensor3D,
*   offsets: tf.Tensor3D,
*   displacementFwd: tf.Tensor3D,
*   displacementBwd: tf.Tensor3D,
*   padding: Padding,
*   internalResolutionHeightAndWidth: [number, number]
* } {
*   const [height, width] = getInputSize(input);
*   const internalResolutionHeightAndWidth =
*   toInputResolutionHeightAndWidth(
*     internalResolution, this.baseModel.outputStride, [height, width]);
*   const {resized, padding} = padAndResizeTo(input, internalResolutionHeightAndWidth);
*   const {
*     segmentation, heatmapScores, offsets, displacementFwd, displacementBwd
*   } = tf.tidy(() => {
*     const {
*       segmentLogits, heatmapScores, offsets, displacementFwd, displacementBwd
*     } = this.predictForPersonSegmentation(resized);
*     const [resizedHeight, resizedWidth] = resized.shape;
*     const scaledSegmentScores = scaleAndCropToInputTensorShape(
*       segmentLogits, [height, width], [resizedHeight, resizedWidth],
*       [[padding.top, padding.bottom], [padding.left, padding.right]],
*       APPLY_SIGMOID_ACTIVATION);
*     return {
*       segmentation: toMaskTensor(
*         tf.squeeze(scaledSegmentScores), segmentationThreshold),
*       heatmapScores, offsets, displacementFwd, displacementBwd,
*     };
*   });
*   resized.dispose();
*   return {
*     segmentation, heatmapScores, offsets, displacementFwd, displacementBwd, padding,
*     internalResolutionHeightAndWidth
*   };
* }
*
* Given an image with many people, returns a PersonSegmentation dictionary that contains the segmentation mask for all people and a single pose.
* Note: The segmentation mask returned by this method covers all people but the pose works well for one person. If you want to estimate instance-level multiple person segmentation & pose for each person, use `segmentMultiPerson` instead.
* @param input
* ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)
* The input image to feed through the network.
* @param config PersonInferenceConfig object that contains parameters for the BodyPix inference using person decoding.
* @return A SemanticPersonSegmentation dictionary that contains height, width, the flattened binary segmentation mask and the poses for all people.
* The width and height correspond to the same dimensions of the input image.
* - `height`: The height of the segmentation data in pixel unit.
* - `width`: The width of the segmentation data in pixel unit.
* - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel belongs to a person and 0 means the pixel doesn't belong to a person. The size of the array is equal to `height` x `width` in row-major order.
* - `allPoses`: The 2d poses of all people.
*
* async segmentPerson(
*   input: BodyPixInput,
*   config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):
*   Promise<SemanticPersonSegmentation> {
*     config = {...PERSON_INFERENCE_CONFIG, ...config};
*     validatePersonInferenceConfig(config);
*     const {
*       segmentation, heatmapScores, offsets, displacementFwd, displacementBwd, padding,
*       internalResolutionHeightAndWidth
*     } = this.segmentPersonActivation(
*       input, config.internalResolution, config.segmentationThreshold);
*     const [height, width] = segmentation.shape;
*     const result = await segmentation.data() as Uint8Array;
*     segmentation.dispose();
*     const tensorBuffers = await toTensorBuffers3D(
*       [heatmapScores, offsets, displacementFwd, displacementBwd]);
*     const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] = tensorBuffers;
*     let poses = decodeMultiplePoses(
*       scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
*       this.baseModel.outputStride, config.maxDetections, config.scoreThreshold, config.nmsRadius);
*     poses = scaleAndFlipPoses(
*       poses, [height, width], internalResolutionHeightAndWidth, padding,
*       FLIP_POSES_AFTER_SCALING);
*     heatmapScores.dispose();
*     offsets.dispose();
*     displacementFwd.dispose();
*     displacementBwd.dispose();
*     return {height, width, data: result, allPoses:

```


poses};\n }\n\n /**\n * Given an image with multiple people, returns an *array* of\n * PersonSegmentation object. Each element in the array corresponding to one\n * of the people in the input image. In other words, it predicts\n * instance-level multiple person segmentation & pose for each person.\n *\n * The model does standard ImageNet pre-processing before inferring through\n * the model. The image pixels should have values [0-255].\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input\n * image to feed through the network.\n *\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for the BodyPix inference using multi-person decoding.\n *\n * @return An array of PersonSegmentation object, each containing a width,\n * height, a binary array (1 for the pixels that are part of the\n * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n * number of pixels in the image. The width and height correspond to the\n * dimensions of the image the binary array is shaped to, which are the same\n * dimensions of the input image.\n */\n async segmentMultiPerson(\n input: BodyPixInput,\n config: MultiPersonInstanceInferenceConfig =\n MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n Promise<PersonSegmentation[]> {\n config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n ...config};\n validateMultiPersonInstanceInferenceConfig(config);\n const [height, width] =\n getInputSize(input);\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n config.internalResolution, this.baseModel.outputStride,\n [height, width]);\n\n const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n const {\n segmentation,\n longOffsets,\n heatmapScoresRaw,\n offsetsRaw,\n displacementFwdRaw,\n displacementBwdRaw,\n } = tf.tidy(() => {\n const {\n segmentLogits,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } =\n this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n const scaledSegmentScores =\n scaleAndCropToInputTensorShape(\n segmentLogits, [height, width], internalResolutionHeightAndWidth,\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n const longOffsetsResized = false;\n let scaledLongOffsets;\n if (longOffsetsResized) {\n scaledLongOffsets = scaleAndCropToInputTensorShape(\n longOffsets, [height, width],\n internalResolutionHeightAndWidth,\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n } else {\n scaledLongOffsets = longOffsets;\n }\n\n const\n segmentation = toMaskTensor(\n tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n return {\n segmentation,\n longOffsets: scaledLongOffsets,\n heatmapScoresRaw: heatmapScores,\n offsetsRaw: offsets,\n displacementFwdRaw: displacementFwd,\n displacementBwdRaw:\n displacementBwd,\n };\n });\n\n const tensorBuffers = await toTensorBuffers3D(\n [heatmapScoresRaw,\n offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n const [scoresBuf, offsetsBuf,\n displacementsFwdBuf, displacementsBwdBuf] =\n tensorBuffers;\n\n let poses = decodeMultiplePoses(\n scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n this.baseModel.outputStride,\n config.maxDetections,\n config.scoreThreshold, config.nmsRadius);\n\n poses = scaleAndFlipPoses(\n poses, [height, width], internalResolutionHeightAndWidth, padding,\n FLIP_POSES_AFTER_SCALING);\n\n const instanceMasks = await decodePersonInstanceMasks(\n segmentation, longOffsets, poses, height, width,\n this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n config.scoreThreshold,\n config.refineSteps, config.minKeypointScore,\n config.maxDetections);\n\n resized.dispose();\n segmentation.dispose();\n longOffsets.dispose();\n heatmapScoresRaw.dispose();\n offsetsRaw.dispose();\n displacementFwdRaw.dispose();\n displacementBwdRaw.dispose();\n\n return instanceMasks;\n }\n\n /**\n * Given an image with many people, returns a dictionary containing: height,\n * width, a tensor with a part id from 0-24 for the pixels that are\n * part of a corresponding body part, and -1 otherwise. This does standard\n * ImageNet pre-processing before inferring through the model. The image\n * should pixels should have values [0-255].\n *\n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n *\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * percentage that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high',


```

this.segmentPersonPartsActivation(\n      input, config.internalResolution, config.segmentationThreshold);\n\nconst [height, width] = partSegmentation.shape;\n  const data = await partSegmentation.data() as Int32Array;\n  partSegmentation.dispose();\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScores, offsets,\n    displacementFwd, displacementBwd]);\n  const [scoresBuf, offsetsBuf, displacementsFwdBuf,\n    displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf,\n    displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n    poses, [height, width],\n    internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n  heatmapScores.dispose();\n  offsets.dispose();\n  displacementFwd.dispose();\n  displacementBwd.dispose();\n\n  return {height, width, data, allPoses: poses};\n} \n\n/**\n * Given an image with multiple people, returns an\n *array* of PartSegmentation\n * object. Each element in the array corresponding to one\n * of the people in the\n * input image. In other words, it predicts\n * instance-level multiple person body part segmentation & pose for\n * each\n * person.\n *\n * This does standard ImageNet pre-processing before inferring through\n * the model.\n * The image pixels should have values [0-255].\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed\n * through the network.\n *\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for\n * the BodyPix inference using multi-person decoding.\n *\n * @return An array of PartSegmentation object, each\n * containing a width,\n * height, a flattened array (with part id from 0-24 for the pixels that are\n * part of a\n * corresponding body part, and -1 otherwise) and 2D pose. The width\n * and height correspond to the dimensions of\n * the image. Each flattened part\n * segmentation array size is equal to `height` x `width`.\n */\n\nasync\nsegmentMultiPersonParts(\n  input: BodyPixInput,\n  config: MultiPersonInstanceInferenceConfig =\n    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {\n  config =\n    {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};\n\n  validateMultiPersonInstanceInferenceConfig(config);\n  const [height, width] = getInputSize(input);\n  const\n    internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n      config.internalResolution,\n      this.baseModel.outputStride,\n      [height, width]);\n  const {resized, padding} =\n    padAndResizeTo(input,\n    internalResolutionHeightAndWidth);\n  const {\n    segmentation,\n    longOffsets,\n    heatmapScoresRaw,\n    offsetsRaw,\n    displacementFwdRaw,\n    displacementBwdRaw,\n    partSegmentation,\n  } = tf.tidy(() =>\n    {\n      const {\n        segmentLogits,\n        longOffsets,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        partHeatmaps\n      } =\n        this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n      // decoding with scaling.\n      const\n        scaledSegmentScores = scaleAndCropToInputTensorShape(\n          segmentLogits, [height, width],\n          internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n      // decoding with scaling.\n      const scaledPartSegmentationScores =\n        scaleAndCropToInputTensorShape(\n          partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n      const scaledLongOffsets = longOffsets;\n      const segmentation = toMaskTensor(\n        tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n      const partSegmentation =\n        decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n      return {\n        segmentation,\n        longOffsets:\n          scaledLongOffsets,\n        heatmapScoresRaw: heatmapScores,\n        offsetsRaw: offsets,\n        displacementFwdRaw: displacementFwd,\n        displacementBwdRaw: displacementBwd,\n        partSegmentation\n      };\n    });\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScoresRaw,\n    offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf, offsetsBuf,\n    displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride,\n    config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n    poses, [height, width], internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n  const instanceMasks = await decodePersonInstancePartMasks(\n    segmentation, longOffsets, partSegmentation,\n
```

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poses, height, width,\n      this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n      config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n      config.maxDetections);\n      resized.dispose();\n      segmentation.dispose();\n      longOffsets.dispose();\n      heatmapScoresRaw.dispose();\n      offsetsRaw.dispose();\n      displacementFwdRaw.dispose();\n      displacementBwdRaw.dispose();\n      partSegmentation.dispose();\n      return instanceMasks;\n    }\n\n    public dispose() {\n      this.baseModel.dispose();\n    }\n  }\n\n  /**\n   * Loads the MobileNet BodyPix model.\n   */\n  @nasync function loadMobileNet(config: ModelConfig):\n  Promise<BodyPix> {\n    const outputStride = config.outputStride;\n    const quantBytes = config.quantBytes;\n    const multiplier = config.multiplier;\n    if (tf == null) {\n      throw new Error(`Cannot find TensorFlow.js. If you are\n        using a <script> tag, please ` +\n        `also include @tensorflow/tfjs on the page before using this\n        model.`);\n    }\n    const url = mobileNetSavedModel(outputStride, multiplier, quantBytes);\n    const graphModel = await\n      tfconv.loadGraphModel(config.modelUrl || url);\n    const mobilenet = new MobileNet(graphModel, outputStride);\n    return new BodyPix(mobilenet);\n  }\n\n  /**\n   * Loads the ResNet BodyPix model.\n   */\n  @nasync function\n  loadResNet(config: ModelConfig): Promise<BodyPix> {\n    const outputStride = config.outputStride;\n    const\n      quantBytes = config.quantBytes;\n    if (tf == null) {\n      throw new Error(`Cannot find TensorFlow.js. If you\n        are using a <script> tag, please ` +\n        `also include @tensorflow/tfjs on the page before using this\n        model.`);\n    }\n    const url = resNet50SavedModel(outputStride, quantBytes);\n    const graphModel = await\n      tfconv.loadGraphModel(config.modelUrl || url);\n    const resnet = new ResNet(graphModel, outputStride);\n    return\n      new BodyPix(resnet);\n  }\n\n  /**\n   * Loads the BodyPix model instance from a checkpoint, with the ResNet\n   * or\n   * MobileNet architecture. The model to be loaded is configurable using the\n   * config dictionary ModelConfig. Please find more details in the\n   * documentation of the ModelConfig.\n   */\n  @param config ModelConfig dictionary that contains parameters for\n   * the BodyPix loading process. Please find more details of each parameters\n   * in the documentation of the ModelConfig interface. The predefined\n   * `MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n   * for defining your customized config.\n   */\n  @nexport async\n  function load(config: ModelConfig = MOBILENET_V1_CONFIG): Promise<BodyPix> {\n    config =\n      validateModelConfig(config);\n    if (config.architecture === 'ResNet50') {\n      return loadResNet(config);\n    } else if\n      (config.architecture === 'MobileNetV1') {\n      return loadMobileNet(config);\n    } else {\n      return null;\n    }\n  }\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an "AS IS"\n   * BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n  =====\n\n  */\n  @import {cpuBlur} from './blur';\n  @import {Color, PartSegmentation, PersonSegmentation} from\n    './types';\n  @import {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\n  @import {getInputSize} from './util';\n  @nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n  @nconst offScreenCanvases:\n  {[name: string]: Canvas} = {};\n  @ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\n  @ntype\n  HasDimensions = {\n    width: number,\n    height: number\n  };\n  @nfunction isSafari() {\n    return\n      (/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n  }\n  @nfunction assertSameDimensions(\n    {width:\n      widthA, height: heightA}: HasDimensions,\n    {width: widthB, height: heightB}: HasDimensions, nameA: string,\n    nameB: string) {\n    if (widthA !== widthB || heightA !== heightB) {\n      throw new Error(`error: dimensions must\n        match. ${nameA} has dimensions ${\n          widthA}x${heightA}, ${nameB} has dimensions\n          ${widthB}x${heightB}`);\n    }\n  }\n  @nfunction flipCanvasHorizontal(canvas: Canvas) {\n    const ctx =\n      canvas.getContext('2d');\n    ctx.scale(-1, 1);\n    ctx.translate(-canvas.width, 0);\n  }\n  @nfunction\n  drawWithCompositing(\n    ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n    image:\n    Canvas|ImageType,\n    compositeOperation: string) {\n    ctx.globalCompositeOperation = compositeOperation;\n    ctx.drawImage(image, 0, 0);\n  }\n  @nfunction createOffScreenCanvas(): Canvas {\n    if (typeof document !==\n      'undefined') {\n      return document.createElement('canvas');\n    } else if (typeof OffscreenCanvas !== 'undefined')\n
```

```

{\n  return new OffscreenCanvas(0, 0);\n } else {\n  throw new Error('Cannot create a canvas in this context');\n
}\n}\n\nfunction ensureOffscreenCanvasCreated(id: string): Canvas {\n if (!offScreenCanvases[id]) {\n
offScreenCanvases[id] = createOffScreenCanvas();\n }\n return offScreenCanvases[id];\n}\n\nfunction
drawAndBlurImageOnCanvas(\n  image: ImageType, blurAmount: number, canvas: Canvas) {\n const {height,
width} = image;\n const ctx = canvas.getContext('2d');\n canvas.width = width;\n canvas.height = height;\n
ctx.clearRect(0, 0, width, height);\n ctx.save();\n if (isSafari()) {\n  cpuBlur(canvas, image, blurAmount);\n } else
{\n  // tslint:disable:no-any\n  (ctx as any).filter = `blur(${blurAmount}px)`;\n  ctx.drawImage(image, 0, 0,
width, height);\n }\n ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n  image: ImageType,
blurAmount: number,\n  offscreenCanvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(offscreenCanvasName);\n if (blurAmount === 0) {\n
renderImageToCanvas(image, canvas);\n } else {\n  drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n
}\n return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n const {width,
height} = image;\n canvas.width = width;\n canvas.height = height;\n const ctx = canvas.getContext('2d');\n\n
ctx.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\nfunction
renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n canvas.width = image.width;\n canvas.height
= image.height;\n const ctx = canvas.getContext('2d');\n\n ctx.putImageData(image, 0, 0);\n}\n\nfunction
renderImageDataToOffScreenCanvas(\n  image: ImageData, canvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(canvasName);\n renderImageDataToCanvas(image, canvas);\n\n return
canvas;\n}\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with
foreground and background color at each pixel determined by the\n * corresponding binary segmentation value at
the pixel from the output. In\n * other words, pixels where there is a person will be colored with foreground\n *
color and where there is not a person will be colored with background color.\n *\n * @param
personOrPartSegmentation The output from\n * `segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts`
or `segmentMultiPersonParts`. They can\n * be SemanticPersonSegmentation object, an array of
PersonSegmentation object,\n * SemanticPartSegmentation object, or an array of PartSegmentation object.\n *\n *
@param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground color\n * (r,g,b,a) for visualizing pixels that
belong to people.\n *\n * @param background Default to {r:0, g:0, b:0, a: 255}. The background color\n * (r,g,b,a)
for visualizing pixels that don't belong to people.\n *\n * @param drawContour Default to false. Whether to draw
the contour around each\n * person's segmentation mask or body part mask.\n *\n * @param foregroundIds Default
to [1]. The integer values that represent\n * foreground. For person segmentation, 1 is the foreground. For body
part\n * segmentation, it can be a subset of all body parts ids.\n *\n * @returns An ImageData with the same width
and height of\n * all the PersonSegmentation in multiPersonSegmentation, with opacity and\n * transparency at each
pixel determined by the corresponding binary\n * segmentation value at the pixel from the output.\n */\nexport
function toMask(\n  personOrPartSegmentation: SemanticPersonSegmentation|\n
SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n  foreground: Color = {\n  r: 0,\n  g:
0,\n  b: 0,\n  a: 0\n },\n  background: Color = {\n  r: 0,\n  g: 0,\n  b: 0,\n  a: 255\n },\n
drawContour = false, foregroundIds: number[] = [1]): ImageData {\n if (Array.isArray(personOrPartSegmentation)
&&\n  personOrPartSegmentation.length === 0) {\n  return null;\n }\n\n let multiPersonOrPartSegmentation:\n
  Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n
PersonSegmentation|PartSegmentation>;\n\n if (!Array.isArray(personOrPartSegmentation)) {\n
multiPersonOrPartSegmentation = [personOrPartSegmentation];\n } else {\n  multiPersonOrPartSegmentation =
personOrPartSegmentation;\n }\n\n const {width, height} = multiPersonOrPartSegmentation[0];\n const bytes =
new Uint8ClampedArray(width * height * 4);\n\n function drawStroke(\n  bytes: Uint8ClampedArray, row:
number, column: number, width: number,\n  radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {\n
for (let i = -radius; i <= radius; i++) {\n  for (let j = -radius; j <= radius; j++) {\n  if (i !== 0 && j !== 0) {\n
const n = (row + i) * width + (column + j);\n  bytes[4 * n + 0] = color.r;\n  bytes[4 * n + 1] = color.g;\n
bytes[4 * n + 2] = color.b;\n  bytes[4 * n + 3] = color.a;\n  }\n }\n }\n }\n\n function
isSegmentationBoundary(\n  segmentationData: Uint8Array|Int32Array,\n  row: number,\n  column:

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number,\n width: number,\n foregroundIds: number[] = [1],\n radius = 1,\n ): boolean {\n let
numberBackgroundPixels = 0;\n for (let i = -radius; i <= radius; i++) {\n for (let j = -radius; j <= radius; j++)
{\n if (i !== 0 && j !== 0) {\n const n = (row + i) * width + (column + j);\n if
(!foregroundIds.some(id => id === segmentationData[n])) {\n numberBackgroundPixels += 1;\n }\n
}\n }\n return numberBackgroundPixels > 0;\n }\n\n for (let i = 0; i < height; i += 1) {\n for (let j = 0; j
< width; j += 1) {\n const n = i * width + j;\n bytes[4 * n + 0] = background.r;\n bytes[4 * n + 1] =
background.g;\n bytes[4 * n + 2] = background.b;\n bytes[4 * n + 3] = background.a;\n for (let k = 0; k <
multiPersonOrPartSegmentation.length; k++) {\n if (foregroundIds.some(\n id => id ===
multiPersonOrPartSegmentation[k].data[n])) {\n bytes[4 * n] = foreground.r;\n bytes[4 * n + 1] =
foreground.g;\n bytes[4 * n + 2] = foreground.b;\n bytes[4 * n + 3] = foreground.a;\n const
isBoundary = isSegmentationBoundary(\n multiPersonOrPartSegmentation[k].data, i, j, width,\n
foregroundIds);\n if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 &&\n j + 1 < width
&& isBoundary) {\n drawStroke(bytes, i, j, width, 1);\n }\n }\n }\n }\n }\n\n return new
ImageData(bytes, width, height);\n}\n\nconst RAINBOW_PART_COLORS: Array<[number, number, number]> =
[\n [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255, 94, 99],
[255, 115, 75],\n [255, 140, 56], [239, 167, 47], [217, 194, 49], [194, 219, 64],\n [175, 240, 91], [135, 245, 87],
[96, 247, 96], [64, 243, 115],\n [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213],\n [47, 150, 224], [65,
125, 224], [84, 101, 214], [99, 81, 195]];\n\n/**\n * Given the output from person body part segmentation (or
multi-person\n * instance body part segmentation) and an array of colors indexed by part id,\n * generates an image
with the corresponding color for each part at each pixel,\n * and white pixels where there is no part.\n *\n * @param
partSegmentation The output from segmentPersonParts\n * or segmentMultiPersonParts. The former is a
SemanticPartSegmentation\n * object and later is an array of PartSegmentation object.\n *\n * @param partColors A
multi-dimensional array of rgb colors indexed by\n * part id. Must have 24 colors, one for every part.\n *\n *
@return An ImageData with the same width and height of all the element in\n * multiPersonPartSegmentation,
with the corresponding color for each part at\n * each pixel, and black pixels where there is no part.\n */\n\nexport
function toColoredPartMask(\n partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n partColors:
Array<[number, number, number]> =\n RAINBOW_PART_COLORS): ImageData {\n if
(Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n return null;\n }\n\n let
multiPersonPartSegmentation;\n if (!Array.isArray(partSegmentation)) {\n multiPersonPartSegmentation =
[partSegmentation];\n } else {\n multiPersonPartSegmentation = partSegmentation;\n }\n\n const {width, height}
= multiPersonPartSegmentation[0];\n const bytes = new Uint8ClampedArray(width * height * 4);\n\n for (let i = 0;
i < height * width; ++i) {\n // invert mask. Invert the segmentation mask.\n const j = i * 4;\n bytes[j + 0] =
255;\n bytes[j + 1] = 255;\n bytes[j + 2] = 255;\n bytes[j + 3] = 255;\n for (let k = 0; k <
multiPersonPartSegmentation.length; k++) {\n const partId = multiPersonPartSegmentation[k].data[i];\n if
(partId !== -1) {\n const color = partColors[partId];\n if (!color) {\n throw new Error(`No color could
be found for part id ${partId}`);\n }\n bytes[j + 0] = color[0];\n bytes[j + 1] = color[1];\n bytes[j +
2] = color[2];\n bytes[j + 3] = 255;\n }\n }\n }\n\n return new ImageData(bytes, width, height);\n}\n\nconst
CANVAS_NAMES = {\n blurred: 'blurred',\n blurredMask: 'blurred-mask',\n mask: 'mask',\n lowresPartMask:
'lowres-part-mask',\n};\n\n/**\n * Given an image and a maskImage of type ImageData, draws the image with the\n
* mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param image The
original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask. Ideally this
should be\n * generated by toMask or toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask
when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param
maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n
*\n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n */\n\nexport function
drawMask(\n canvas: Canvas, image: ImageType, maskImage: ImageData|null,\n maskOpacity = 0.7,\n maskBlurAmount = 0, flipHorizontal = false) {\n const [height, width] = getInputSize(image);\n canvas.width =
width;\n canvas.height = height;\n\n const ctx = canvas.getContext('2d');\n ctx.save();\n if (flipHorizontal) {\n

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flipCanvasHorizontal(canvas);\n }\n\n ctx.drawImage(image, 0, 0);\n\n ctx.globalAlpha = maskOpacity;\n if
(maskImage) {\n  assertSameDimensions({ width, height }, maskImage, 'image', 'mask');\n\n  const mask =
renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n  const blurredMask =
drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount, CANVAS_NAMES.blurredMask);\n\n  ctx.drawImage(blurredMask, 0, 0, width, height);\n }\n\n ctx.restore();\n}\n\n/**\n * Given an image and a
maskImage of type ImageData, draws the image with the\n * pixelated mask on top of it onto a canvas.\n *\n *
@param canvas The canvas to be drawn onto.\n *\n * @param image The original image to apply the mask to.\n *\n
* @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by
toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask when drawing it on top of the\n *
image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How many pixels to
blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the
result should be flipped horizontally. Defaults\n * to false.\n *\n * @param pixelCellWidth The width of each pixel
cell. Default to 10 px.\n */\n\nexport function drawPixelatedMask(\n  canvas: Canvas, image: ImageType,
maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth =
10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({ width, height }, maskImage,
'image', 'mask');\n\n  const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n
const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount,
CANVAS_NAMES.blurredMask);\n\n  canvas.width = blurredMask.width;\n  canvas.height =
blurredMask.height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n
flipCanvasHorizontal(canvas);\n  }\n\n  const offscreenCanvas =\n  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =
offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n
offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n
blurredMask, 0, 0, blurredMask.width, blurredMask.height, 0, 0,\n    offscreenCanvas.width,
offscreenCanvas.height);\n  ctx.imageSmoothingEnabled = false;\n  ctx.drawImage(\n    offscreenCanvas, 0, 0,
offscreenCanvas.width, offscreenCanvas.height, 0,\n    0, canvas.width, canvas.height);\n\n  // Draws vertical grid
lines that are `pixelCellWidth` apart from each other.\n  for (let i = 0; i < offscreenCanvas.width; i++) {\n
ctx.beginPath();\n  ctx.strokeStyle = '#ffffff';\n  ctx.moveTo(pixelCellWidth * i, 0);\n  ctx.lineTo(pixelCellWidth
* i, canvas.height);\n  ctx.stroke();\n }\n\n  // Draws horizontal grid lines that are `pixelCellWidth` apart from
each\n // other.\n  for (let i = 0; i < offscreenCanvas.height; i++) {\n  ctx.beginPath();\n  ctx.strokeStyle =
'#ffffff';\n  ctx.moveTo(0, pixelCellWidth * i);\n  ctx.lineTo(canvas.width, pixelCellWidth * i);\n  ctx.stroke();\n
}\n\n  ctx.globalAlpha = 1.0 - maskOpacity;\n  ctx.drawImage(image, 0, 0, blurredMask.width,
blurredMask.height);\n  ctx.restore();\n}\n\nfunction createPersonMask(\n  multiPersonSegmentation:
PersonSegmentation[]|SemanticPersonSegmentation,\n  edgeBlurAmount: number): Canvas {\n  const
backgroundMaskImage = toMask(\n    multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n    {r: 0, g: 0, b: 0, a:
0});\n\n  const backgroundMask =\n    renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n    return backgroundMask;\n  } else {\n    return
drawAndBlurImageOnOffScreenCanvas(\n    backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred
image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param
personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation object.\n *\n * @param
backgroundBlurAmount How many pixels in the background blend into each\n * other. Defaults to 3. Should be an
integer between 1 and 20.\n *\n * @param edgeBlurAmount How many pixels to blur on the edge between the
person\n * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n *\n * @param
flipHorizontal If the output should be flipped horizontally. Defaults\n * to false.\n */\n\nexport function
drawBokehEffect(\n  canvas: Canvas, image: ImageType,\n  multiPersonSegmentation:
SemanticPersonSegmentation|PersonSegmentation[],\n  backgroundBlurAmount = 3, edgeBlurAmount = 3,

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flipHorizontal = false) {\n  const blurredImage = drawAndBlurImageOnOffScreenCanvas(\n    image,
backgroundBlurAmount, CANVAS_NAMES.blurred);\n  canvas.width = blurredImage.width;\n  canvas.height =
blurredImage.height;\n\n  const ctx = canvas.getContext('2d');\n\n  if (Array.isArray(multiPersonSegmentation)
&&\n    multiPersonSegmentation.length === 0) {\n    ctx.drawImage(blurredImage, 0, 0);\n    return;\n  }\n\n  const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\n  ctx.save();\n  if
(flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n  // draw the original image on the final canvas\n  const
[height, width] = getInputSize(image);\n  ctx.drawImage(image, 0, 0, width, height);\n\n  // \"destination-in\" - \"The
existing canvas content is kept where both the\n  // new shape and existing canvas content overlap. Everything else
is made\n  // transparent.\"\n  // crop what's not the person using the mask from the original image\n  drawWithCompositing(ctx, personMask, 'destination-in');\n  // \"destination-over\" - \"The existing canvas content is
kept where both the\n  // new shape and existing canvas content overlap. Everything else is made\n  //
transparent.\"\n  // draw the blurred background on top of the original image where it doesn't\n  // overlap.\n  drawWithCompositing(ctx, blurredImage, 'destination-over');\n  ctx.restore();\n}\n\nfunction
createBodyPartMask(\n  multiPersonPartSegmentation: SemanticPartSegmentation|PartSegmentation[],\n  bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {\n  const backgroundMaskImage = toMask(\n    multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},\n    {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);\n\n  const backgroundMask =\n    renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n    return backgroundMask;\n  } else {\n    return
drawAndBlurImageOnOffScreenCanvas(\n    backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n * @param canvas The canvas to draw the background-blurred
image onto.\n * @param image The image to blur the background of and draw.\n * @param
partSegmentation A SemanticPartSegmentation or an array of\n * PartSegmentation object.\n * @param
bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An\n * array of body part ids to blur. Each must be
one of the 24 body part ids.\n * @param backgroundBlurAmount How many pixels in the background blend into
each\n * other. Defaults to 3. Should be an integer between 1 and 20.\n * @param edgeBlurAmount How many
pixels to blur on the edge between the person\n * and the background by. Defaults to 3. Should be an integer
between 0 and 20.\n * @param flipHorizontal If the output should be flipped horizontally. Defaults\n * to
false.\n */\nexport function blurBodyPart(\n  canvas: Canvas, image: ImageType,\n  partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n  bodyPartIdsToBlur = [0, 1], backgroundBlurAmount = 3,
edgeBlurAmount = 3,\n  flipHorizontal = false) {\n  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(\n    image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n\n  canvas.width = blurredImage.width;\n  canvas.height = blurredImage.height;\n\n  const ctx =
canvas.getContext('2d');\n\n  if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n    ctx.drawImage(blurredImage, 0, 0);\n    return;\n  }\n\n  const bodyPartMask =\n    createBodyPartMask(partSegmentation, bodyPartIdsToBlur, edgeBlurAmount);\n\n  ctx.save();\n  if (flipHorizontal)
{\n    flipCanvasHorizontal(canvas);\n  }\n  // draw the original image on the final canvas\n  const [height, width] =
getInputSize(image);\n  ctx.drawImage(image, 0, 0, width, height);\n\n  // \"destination-in\" - \"The existing canvas
content is kept where both the\n  // new shape and existing canvas content overlap. Everything else is made\n  //
transparent.\"\n  // crop what's not the person using the mask from the original image\n  drawWithCompositing(ctx,
bodyPartMask, 'destination-in');\n  // \"destination-over\" - \"The existing canvas content is kept where both the\n  //
new shape and existing canvas content overlap. Everything else is made\n  // transparent.\"\n  // draw the blurred
background on top of the original image where it doesn't\n  // overlap.\n  drawWithCompositing(ctx, blurredImage,
'destination-over');\n  ctx.restore();\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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compliance with the License.\n * You may obtain a copy of the License at\n * \n
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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tsData", "dataArrays", "Uint8Array", "j", "n", "decodeMultipleMasksCPU", "decodePersonInstancePartMasks", "partSegmentation", "partSegmentations", "bodyParts", "toPersonKPartSegmentation", "partSegmentationsByPersonData", "partSegmentaionData", "partSegmentaion", "Int32Array", "decodeMultiplePartMasksCPU", "half", "floor", "maxSize", "getElementValue", "priorityQueue", "Array", "numberOfElements", "MaxHeap", "swim", "exchange", "sink", "less", "getValueAt", "scoreIsMaximumInLocalWindow", "keypointId", "localMaximumRadius", "scores", "localMaximum", "yStart", "yEnd", "yCurrent", "xStart", "xEnd", "xCurrent", "parentChildrenTuples", "parentJoinName", "childJoinName", "parentToChildEdges", "childToParentEdges", "getStridedIndexNearPoint", "point", "traverseToTargetKeypoint", "edgeId", "sourceKeypoint", "targetKeypointId", "scoresBuffer", "displacements", "offsetRefineStep", "displacement", "numEdges", "getDisplacement", "targetKeypoint", "targetKeypointIndices", "offsetPoint", "targetKeypointIndices", "decodePose", "root", "displacementsFwd", "displacementsBwd", "instanceKeypoints", "rootPart", "rootScore", "rootPoint", "id", "edge", "sourceKeypointId", "withinNmsRadiusOfCorrespondingPoint", "squaredNmsRadius", "some", "y1", "x1", "y2", "x2", "correspondingKeypoint", "getInstanceScore", "existingPoses", "kLocalMaximumRadius", "decodeMultiplePoses", "offsetsBuffer", "displacementsFwdBuffer", "displacementsBwdBuffer", "maxPoseDetections", "scoreThreshold", "nmsRadius", "queue", "numKeypoints", "enqueue", "buildPartWithScoreQueue", "empty", "dequeue", "imageNetMean", "ResNet", "RESNET50_BASE_URL", "MOBILENET_BASE_URL", "getInputSize", "HTMLCanvasElement", "OffscreenCanvas", "HTMLImageElement", "offsetHeight", "offsetWidth", "Error", "getSizeFromImageLikeElement", "ImageData", "HTMLVideoElement", "hasAttribute", "videoHeight", "videoWidth", "getSizeFromVideoElement", "tf.Tensor", "toValidInputResolution", "inputResolution", "resolution", "isValidInputResolution", "INTERNAL_RESOLUTION_STRING_OPTIONS", "low", "medium", "high", "full", "INTERNAL_RESOLUTION_PERCENTAGES", "MIN_INTERNAL_RESOLUTION", "MAX_INTERNAL_RESOLUTION", "toInputResolutionHeightAndWidth", "internalResolution", "inputHeight", "inputWidth", "internalResolutionPercentage", "Object", "values", "join", "toInternalResolutionPercentage", "scaleAndCropToInputTensorShape", "tensor", "applySigmoidActivation", "inputTensorHeight", "inputTensorWidth", "resizedAndPaddedHeight", "resizedAndPaddedWidth", "_e", "padR", "inResizedAndPadded", "tf.image", "resizeBilinear", "resizedAndPadded", "originalHeight", "originalWidth", "batchedImage", "cropAndResize", "removePaddingAndResizeBack", "padAndResizeTo", "targetH", "targetW", "targetAspect", "resized", "imageTensor", "tf.browser", "fromPixels", "toInputTensor", "tf.pad3d", "top", "left", "right", "bottom", "toTensorBuffers3D", "tensors", "buffer", "flipPoseHorizontal", "imageWidth", "scaleAndFlipPoses", "flipHorizontal", "inputResolutionHeight", "inputResolutionWidth", "scaledPoses", "offsetY", "offsetX", "scalePose", "scalePoses", "flipPosesHorizontal", "MOBILENET_V1_CONFIG", "architecture", "quantBytes", "multiplier", "VALID_ARCHITECTURE", "VALID_STRIDE", "MobileNetV1", "ResNet50", "VALID_MULTIPLIER", "VALID_QUANT_BYTES", "PERSON_INFERENCE_CONFIG", "segmentationThreshold", "maxDetections", "MULTI_PERSON_INSTANCE_INFERENCE_CONFIG", "validatePersonInferenceConfig", "config", "validateMultiPersonInstanceInferenceConfig", "net", "baseModel", "BodyPix", "segmentLogits", "partHeatmapLogits", "internalResolutionHeightAndWidth", "predictForPersonSegmentation", "resizedHeight", "resizedWidth", "scaledSegmentScores", "segmentPersonActivation", "tensorBuffers", "scoresBuf", "offsetsBuf", "displacementsFwdBuf", "displacementsBwdBuf", "allPoses", "scaledLongOffsets", "predictForMultiPersonInstanceSegmentationAndPart", "heatmapScoresRaw", "offsetsRaw", "displacementFwdRaw", "displacementBwdRaw", "instanceMasks", "predictForPersonSegmentationAndPart", "scaledPartHeatmapScore", "segmentPersonPartsActivation", "scaledPartSegmentationScores", "decodeOnlyPartSegmentation", "loadMobileNet", "tf", "url", "toStr", "1", "0.75", "0.5", "graphJson", "mobileNetSavedModel", "tfconv.loadGraphModel", "modelUrl", "graphModel", "mobilenet", "loadResNet", "resNet50SavedModel", "resnet", "offScreenCanvases", "assertSameDimensions", "nameA", "nameB", "widthA", "heightA", "widthB", "heightB", "flipCanvasHorizontal", "canvas", "ctx", "getContext", "scale", "translate", "drawWithCompositing", "compositeOperation", "globalCompositeOperation", "drawImage", "ensureOffscreenCanvasCreated", "document", "createElement", "createOffscreenCanvas", "drawAndBlurImageOnCanvas", "blurAmount", "clearRect", "save", "test", "navigator", "userAgent", "blur", "sum", "alphaLeft", "PI", "step", "exp", "globalAlpha", "cpuBlur", "restore", "drawAndBlurImageOnOffscreenCanvas", "offscreenCanvasName", "renderImageToCanvas", "renderImageDataToOffscreenCanvas", "canvasName", "putImageData", "renderImageDataToCanvas", "toMask", "personOrPartSegmentation", "foreground", "background", "drawContour", "foregroundIds", "r", "g", "isArray", "multiPersonOrPartSegmentation", "bytes", "Uint8ClampedArray", "drawStroke", "row", "column", "radius", "color", "isSegmentationBoundary", "segmentationData", "numberBa

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

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the part with the highest value. These part ids are clipped by the segmentation mask. Wherever the a pixel is clipped by the segmentation mask, its value will set to -1, indicating that there is no part in that pixel.

@param segmentScores A 3d-tensor of the sigmoid of the segmentation output.

@param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap output. The third dimension corresponds to the part.

@returns A 2d tensor of an image with the corresponding value at each pixel corresponding to the part with the highest value. These part ids are clipped by the segmentation mask. It will have values of -1 for pixels that are outside of the body and do not have a corresponding part.

```

function decodePartSegmentation(
  segmentationMask: tf.Tensor2D,
  partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
  return tf.tidy(() => {
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened = tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
    const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
    const partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));
    return tf.sub(clipByMask2d(partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask), tf.scalar(1, 'int32'));
  });
}

function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {
  const [partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;
  return tf.tidy(() => {
    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);
    const partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);
    const partMapFlattened = tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');
    return tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);
  });
}

```

=====
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 limitations under the License.

```

import * as tfconv from '@tensorflow/tfjs-converter';
import * as tf from '@tensorflow/tfjs-core';
import {BodyPixOutputStride} from './types';

BodyPix supports using various convolution neural network models (e.g. ResNet and MobileNetV1) as its underlying base model. The following BaseModel interface defines a unified interface for creating such BodyPix base models. Currently both MobileNet (in ./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel interface. New base models that conform to the BaseModel interface can be added to BodyPix.

export abstract class BaseModel {
  constructor(
    protected readonly model: tfconv.GraphModel,
    public readonly outputStride: BodyPixOutputStride) {
    const inputShape = this.model.inputs[0].shape as [number, number, number, number];
    tf.util.assert(
      (inputShape[1] === -1) && (inputShape[2] === -1),
      () => `Input shape [${inputShape[1]}, ${inputShape[2]}]` +
      ` must both be equal to or -1`);
  }

  abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;

  /** Predicts intermediate Tensor representations.
   * @param input The input RGB image of the base model.
   * A Tensor of shape: [inputResolution, inputResolution, 3].
   * @return A dictionary of base model's intermediate predictions.
   * The returned dictionary should contains the following elements:
   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.
   * - offsets: A Tensor3D that represents the offsets.
   * - displacementFwd: A Tensor3D that represents the forward displacement.
   * - displacementBwd: A Tensor3D that represents the backward displacement.
   * - segmentation: A Tensor3D that represents the segmentation of all people.
   * - longOffsets: A Tensor3D that represents the long offsets used for instance grouping.
   * - partHeatmaps: A Tensor3D that represents the body part segmentation.
   */
  predict(input: tf.Tensor3D): {
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
    segmentation: tf.Tensor3D,
    partHeatmaps: tf.Tensor3D,
    longOffsets: tf.Tensor3D,
    partOffsets: tf.Tensor3D
  }
  return tf.tidy(() => {
    const asFloat =

```

```

this.preprocessInput(tf.cast(input, 'float32'));\n    const asBatch = tf.expandDims(asFloat, 0);\n    const results =
this.model.predict(asBatch) as tf.Tensor4D[];\n    const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y,
[0]));\n    const namedResults = this.nameOutputResults(results3d);\n\n    return {\n        heatmapScores:
tf.sigmoid(namedResults.heatmap),\n        offsets: namedResults.offsets,\n        displacementFwd:
namedResults.displacementFwd,\n        displacementBwd: namedResults.displacementBwd,\n        segmentation:
namedResults.segmentation,\n        partHeatmaps: namedResults.partHeatmaps,\n        longOffsets:
namedResults.longOffsets,\n        partOffsets: namedResults.partOffsets\n    };;\n    };\n\n    // Because
MobileNet and ResNet predict() methods output a different order for\n    // these values, we have a method that needs
to be implemented to order them.\n    abstract nameOutputResults(results: tf.Tensor3D[]): {\n        heatmap:
tf.Tensor3D,\n        offsets: tf.Tensor3D,\n        displacementFwd: tf.Tensor3D,\n        displacementBwd: tf.Tensor3D,\n        segmentation: tf.Tensor3D,\n        partHeatmaps: tf.Tensor3D,\n        longOffsets: tf.Tensor3D,\n        partOffsets:
tf.Tensor3D\n    };;\n\n    /**\n     * Releases the CPU and GPU memory allocated by the model.\n     */\n    dispose() {\n    this.model.dispose();\n    }\n\n    "/*\n     * @license\n     * Copyright 2019 Google Inc. All Rights Reserved.\n     *
Licensed under the Apache License, Version 2.0 (the "License");\n     * you may not use this file except in
compliance with the License.\n     * You may obtain a copy of the License at\n     */\n     *
http://www.apache.org/licenses/LICENSE-2.0\n     * Unless required by applicable law or agreed to in writing,
software\n     * distributed under the License is distributed on an "AS IS" BASIS,\n     * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for the specific language
governing permissions and\n     * limitations under the License.\n     */
\n\n    =====\n\n    *\n    import * as tf from '@tensorflow/tfjs-core';\n    import { BaseModel } from './base_model';\n    export class
MobileNet extends BaseModel {\n        preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n            // Normalize the pixels
[0, 255] to be between [-1, 1].\n            return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n        }\n\n        nameOutputResults(results: tf.Tensor3D[]) {\n            const [\n                offsets,\n                segmentation,\n                partHeatmaps,\n                longOffsets,\n                heatmap,\n                displacementFwd,\n                displacementBwd,\n                partOffsets,\n            ] = results;\n            return {\n                offsets,\n                segmentation,\n                partHeatmaps,\n                longOffsets,\n                heatmap,\n                displacementFwd,\n                displacementBwd,\n                partOffsets\n            };;\n        }\n\n        "/*\n         * @license\n         * Copyright 2019
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http://www.apache.org/licenses/LICENSE-2.0\n         * Unless required by applicable law or agreed to in writing,
software\n         * distributed under the License is distributed on an "AS IS" BASIS,\n         * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n         * See the License for the specific language
governing permissions and\n         * limitations under the License.\n         */
\n\n        =====\n\n        *\n        export type Tuple<T> = [T, T];\n        export type StringTuple = Tuple<string>;\n        export type NumberTuple =
Tuple<number>;\n\n        export const PART_NAMES = [\n            'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
'leftShoulder',\n            'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n            'leftHip', 'rightHip', 'leftKnee',
'rightKnee', 'leftAnkle', 'rightAnkle'\n        ];\n\n        export const NUM_KEYPOINTS = PART_NAMES.length;\n\n        export
interface NumberDict {\n            [jointName: string]: number;\n        }\n\n        export const PART_IDS =\n        PART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n            result[jointName] = i;\n            return result;\n        }, {});\n\n        const CONNECTED_PART_NAMES: StringTuple[] = [\n            ['leftHip', 'leftShoulder'],
['leftElbow', 'leftShoulder'],\n            ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],\n            ['leftKnee', 'leftAnkle'], ['rightHip',
'rightShoulder'],\n            ['rightElbow', 'rightShoulder'], ['rightElbow', 'rightWrist'],\n            ['rightHip', 'rightKnee'],
['rightKnee', 'rightAnkle'],\n            ['leftShoulder', 'rightShoulder'], ['leftHip', 'rightHip']\n        ];\n\n        /*\n         * Define the skeleton.
This defines the parent->child relationships of our\n         * tree. Arbitrarily this defines the nose as the root of the tree,
however\n         * since we will infer the displacement for both parent->child and\n         * child->parent, we can define the
tree root as any node.\n         */\n        export const POSE_CHAIN: StringTuple[] = [\n            ['nose', 'leftEye'], ['leftEye', 'leftEar'],
['nose', 'rightEye'],\n            ['rightEye', 'rightEar'], ['nose', 'leftShoulder'],\n            ['leftShoulder', 'leftElbow'], ['leftElbow',

```

```

'leftWrist'],\n ['leftShoulder', 'leftHip'], ['leftHip', 'leftKnee'],\n ['leftKnee', 'leftAnkle'], ['nose', 'rightShoulder'],\n
['rightShoulder', 'rightElbow'], ['rightElbow', 'rightWrist'],\n ['rightShoulder', 'rightHip'], ['rightHip', 'rightKnee'],\n
['rightKnee', 'rightAnkle']\n];\n\nexport const CONNECTED_PART_INDICES =
CONNECTED_PART_NAMES.map(\n ([jointNameA, jointNameB]) =>\n ([PART_IDS[jointNameA],
PART_IDS[jointNameB]]);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from
'../types';\n\nexport function getScale(\n [height, width]: [number, number],\n [inputResolutionY,
inputResolutionX]: [number, number],\n padding: Padding): [number, number] {\n const {top: padT, bottom:
padB, left: padL, right: padR} = padding;\n const scaleY = inputResolutionY / (padT + padB + height);\n const
scaleX = inputResolutionX / (padL + padR + width);\n return [scaleX, scaleY];\n}\n\nexport function
getOffsetPoint(\n y: number, x: number, keypoint: number, offsets: TensorBuffer3D): Vector2D {\n return {\n
y: offsets.get(y, x, keypoint),\n x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)\n };\n}\n\nexport function
getImageCoords(\n part: Part, outputStride: number, offsets: TensorBuffer3D): Vector2D {\n const {heatmapY,
heatmapX, id: keypoint} = part;\n const {y, x} = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n return
{\n x: part.heatmapX * outputStride + x,\n y: part.heatmapY * outputStride + y\n };\n}\n\nexport function
fillArray<T>(element: T, size: number): T[] {\n const result: T[] = new Array(size);\n\n for (let i = 0; i < size; i++)
{\n result[i] = element;\n }\n\n return result;\n}\n\nexport function clamp(a: number, min: number, max:
number): number {\n if (a < min) {\n return min;\n }\n if (a > max) {\n return max;\n }\n return
a;\n}\n\nexport function squaredDistance(\n y1: number, x1: number, y2: number, x2: number): number {\n const
dy = y2 - y1;\n const dx = x2 - x1;\n return dy * dy + dx * dx;\n}\n\nexport function addVectors(a: Vector2D, b:
Vector2D): Vector2D {\n return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a: Vector2D, min:
number, max: number): Vector2D {\n return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};\n}\n", "/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Pose} from '../types';\nimport
{getScale} from '../util';\n\ninterface Pair {\n x: number;\n y: number;\n}\n\nfunction computeDistance(embedding:
Pair[], pose: Pose, minPartScore = 0.3) {\n let distance = 0.0;\n let numKpt = 0;\n for (let p = 0; p <
embedding.length; p++) {\n if (pose.keypoints[p].score > minPartScore) {\n numKpt += 1;\n distance +=
(embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n (embedding[p].y - pose.keypoints[p].position.y) **
2;\n }\n }\n if (numKpt === 0) {\n distance = Infinity;\n } else {\n distance = distance / numKpt;\n }\n
return distance;\n}\n\nfunction convertToPositionInOutput(\n position: Pair, [padT, padL]: [number, number],\n [scaleX, scaleY]: [number, number], stride: number): Pair {\n const y = Math.round((((padT + position.y + 1.0) *
scaleY - 1.0) / stride);\n const x = Math.round((((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n return {x,
y};\n}\n\nfunction getEmbedding(\n location: Pair, keypointIndex: number,\n convertToPosition: (pair: Pair) =>
Pair, outputResolutionX: number,\n longOffsets: Float32Array, refineSteps: number,\n [height, width]: [number,
number]): Pair {\n const newLocation = convertToPosition(location);\n\n const nn = newLocation.y *

```

```

outputResolutionX + newLocation.x;\n let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n let
dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n let y = location.y + dy;\n let x =
location.x + dx;\n for (let t = 0; t < refineSteps; t++) {\n y = Math.min(y, height - 1);\n x = Math.min(x, width -
1);\n const newPos = convertToPosition({x, y});\n const nn = newPos.y * outputResolutionX + newPos.x;\n
dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n dx = longOffsets[NUM_KEYPOINTS * (2
* nn + 1) + keypointIndex];\n y = y + dy;\n x = x + dx;\n }\n\n return {x, y};\n}\n\nfunction
matchEmbeddingToInstance(\n location: Pair, longOffsets: Float32Array, poses: Pose[],\n numKptForMatching:
number, [padT, padL]: [number, number],\n [scaleX, scaleY]: [number, number], outputResolutionX: number,\n
[height, width]: [number, number], stride: number,\n refineSteps: number): number {\n const embed: Pair[] = [];\n
const convertToPosition = (pair: Pair) =>\n convertToPositionInOuput(pair, [padT, padL], [scaleX, scaleY],
stride);\n\n for (let keypointsIndex = 0; keypointsIndex < numKptForMatching;\n keypointsIndex++) {\n
const embedding = getEmbedding(\n location, keypointsIndex, convertToPosition, outputResolutionX,\n
longOffsets, refineSteps, [height, width]);\n embed.push(embedding);\n }\n\n let kMin = -1;\n let kMinDist =
Infinity;\n for (let k = 0; k < poses.length; k++) {\n const dist = computeDistance(embed, poses[k]);\n if (dist <
kMinDist) {\n kMin = k;\n kMinDist = dist;\n }\n }\n return kMin;\n}\n\nfunction getOutputResolution(\n
[inputResolutionY, inputResolutionX]: [number, number],\n stride: number): [number, number] {\n const
outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);\n const outputResolutionY =
Math.round((inputResolutionY - 1.0) / stride + 1.0);\n return [outputResolutionX, outputResolutionY];\n}\n\nexport
function decodeMultipleMasksCPU(\n segmentation: Uint8Array, longOffsets: Float32Array,\n
posesAboveScore: Pose[], height: number, width: number, stride: number,\n [inHeight, inWidth]: [number,
number], padding: Padding,\n refineSteps: number, numKptForMatching = 5): Uint8Array[] {\n const dataArrays
=\n posesAboveScore.map(x => new Uint8Array(height * width).fill(0));\n\n const {top: padT, left: padL} =
padding;\n\n const [scaleX, scaleY] =\n getScale([height, width], [inHeight, inWidth], padding);\n const
[outputResolutionX, ] =\n getOutputResolution([inHeight, inWidth], stride);\n for (let i = 0; i < height; i += 1) {\n
for (let j = 0; j < width; j += 1) {\n const n = i * width + j;\n const prob = segmentation[n];\n if (prob ===
1) {\n const kMin = matchEmbeddingToInstance(\n {x: j, y: i}, longOffsets, posesAboveScore,
numKptForMatching,\n [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],\n stride,
refineSteps);\n if (kMin >= 0) {\n dataArrays[kMin][n] = 1;\n }\n }\n }\n }\n\n return
dataArrays;\n}\n\nexport function decodeMultiplePartMasksCPU(\n segmentation: Uint8Array, longOffsets:
Float32Array,\n partSegmentaion: Uint8Array, posesAboveScore: Pose[], height: number,\n width: number,
stride: number, [inHeight, inWidth]: [number, number],\n padding: Padding, refineSteps: number,\n
numKptForMatching = 5): Int32Array[] {\n const dataArrays =\n posesAboveScore.map(x => new
Int32Array(height * width).fill(-1));\n\n const {top: padT, left: padL} = padding;\n\n const [scaleX, scaleY] =\n
getScale([height, width], [inHeight, inWidth], padding);\n const [outputResolutionX, ] =\n
getOutputResolution([inHeight, inWidth], stride);\n\n for (let i = 0; i < height; i += 1) {\n for (let j = 0; j < width; j
+= 1) {\n const n = i * width + j;\n const prob = segmentation[n];\n if (prob === 1) {\n const kMin =
matchEmbeddingToInstance(\n {x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching,\n
[padT, padL], [scaleX, scaleY], outputResolutionX, [height, width],\n stride, refineSteps);\n if (kMin >=
0) {\n dataArrays[kMin][n] = partSegmentaion[n];\n }\n }\n }\n }\n\n return
dataArrays;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from '@tensorflow/tfjs-backend-

```


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```
=====\n\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {getBackend} from '@tensorflow/tfjs-core';\nimport {Padding, PartSegmentation, PersonSegmentation, Pose} from './types';\nimport {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';\nimport {decodeMultipleMasksWebGl} from './decode_multiple_masks_webgl';\n\nexport function toPersonKSegmentation(\n  segmentation: tf.Tensor2D, k: number): tf.Tensor2D {\n  return tf.tidy(() => (tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32') as tf.Tensor2D));\n}\n\nexport function toPersonKPartSegmentation(\n  segmentation: tf.Tensor2D, bodyParts: tf.Tensor2D, k: number): tf.Tensor2D {\n  return tf.tidy(() => tf.sub(tf.mul(tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n}\n\nfunction isWebGLBackend() {\n  return getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[],\n  height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2,\n  refineSteps = 8, minKeypointScore = 0.3, maxNumPeople = 10): Promise<PersonSegmentation[]> {\n  // Filter out poses with smaller score.\n  const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);\n  let personSegmentationsData: Uint8Array[];\n  if (isWebGLBackend()) {\n    const personSegmentations = tf.tidy(() => {\n      const masksTensorInfo = decodeMultipleMasksWebGl(\n        segmentation, longOffsets, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);\n      const masksTensor = tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape, masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map((_, k) => toPersonKSegmentation(masksTensor, k));\n    });\n    personSegmentationsData = (await Promise.all(personSegmentations.map(mask => mask.data())) as Uint8Array[]);\n  } else {\n    const segmentationsData = await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData, longOffsetsData, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps);\n  }\n  return personSegmentationsData.map((data, i) => ({data, pose: posesAboveScore[i], width, height}));\n}\n\nexport async function decodePersonInstancePartMasks(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, partSegmentation: tf.Tensor2D, poses: Pose[],\n  height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding,\n  minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);\n  let partSegmentationsByPersonData: Int32Array[];\n  if (isWebGLBackend()) {\n    const partSegmentations = tf.tidy(() => {\n      const masksTensorInfo = decodeMultipleMasksWebGl(\n        segmentation, longOffsets, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps, minKeypointScore, maxNumPeople);\n      const masksTensor = tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape, masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map((_, k) => toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n    });\n    partSegmentationsByPersonData = (await Promise.all(partSegmentations.map(x => x.data())) as Int32Array[]);\n  } else {\n    const segmentationsData = await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n    const partSegmentaionData = await partSegmentation.data() as Uint8Array;\n    partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n      segmentationsData, longOffsetsData, partSegmentaionData, posesAboveScore, height, width, stride, [inHeight, inWidth], padding, refineSteps);\n  }\n  return partSegmentationsByPersonData.map((data, k) => ({pose: posesAboveScore[k], data, height,
```

width}));\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```
=====\n*\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n// https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\nfunction half(k: number) {\n  return Math.floor(k / 2);\n}\nexport class MaxHeap<T> {\n  private priorityQueue: T[];\n  private numberOfElements: number;\n  private getElementValue: (element: T) => number;\n  constructor(maxSize: number, getElementValue: (element: T) => number) {\n    this.priorityQueue = new Array(maxSize);\n    this.numberOfElements = -1;\n    this.getElementValue = getElementValue;\n  }\n  public enqueue(x: T): void {\n    this.priorityQueue[++this.numberOfElements] = x;\n    this.swim(this.numberOfElements);\n  }\n  public dequeue(): T {\n    const max = this.priorityQueue[0];\n    this.exchange(0, this.numberOfElements--);\n    this.sink(0);\n    this.priorityQueue[this.numberOfElements + 1] = null;\n    return max;\n  }\n  public empty(): boolean {\n    return this.numberOfElements === -1;\n  }\n  public size(): number {\n    return this.numberOfElements + 1;\n  }\n  public all(): T[] {\n    return this.priorityQueue.slice(0, this.numberOfElements + 1);\n  }\n  public max(): T {\n    return this.priorityQueue[0];\n  }\n  private swim(k: number): void {\n    while (k > 0 && this.less(half(k), k)) {\n      this.exchange(k, half(k));\n      k = half(k);\n    }\n  }\n  private sink(k: number): void {\n    while (2 * k <= this.numberOfElements) {\n      let j = 2 * k;\n      if (j < this.numberOfElements && this.less(j, j + 1)) {\n        j++;\n      }\n      if (!this.less(k, j)) {\n        break;\n      }\n      this.exchange(k, j);\n      k = j;\n    }\n  }\n  private getValueAt(i: number): number {\n    return this.getElementValue(this.priorityQueue[i]);\n  }\n  private less(i: number, j: number): boolean {\n    return this.getValueAt(i) < this.getValueAt(j);\n  }\n  private exchange(i: number, j: number): void {\n    const t = this.priorityQueue[i];\n    this.priorityQueue[i] = this.priorityQueue[j];\n    this.priorityQueue[j] = t;\n  }\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {PartWithScore, TensorBuffer3D} from './types';\nimport {MaxHeap} from './max_heap';\nfunction scoreIsMaximumInLocalWindow(\n  keypointId: number, score: number, heatmapY: number, heatmapX: number,\n  localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n  const [height, width] = scores.shape;\n  let localMaximum = true;\n  const yStart = Math.max(heatmapY - localMaximumRadius, 0);\n  const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n  for (let yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n    const xStart = Math.max(heatmapX - localMaximumRadius, 0);\n    const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n    for (let xCurrent = xStart; xCurrent < xEnd; ++xCurrent) {\n      if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n        localMaximum = false;\n        break;\n      }\n    }\n    if (!localMaximum) {\n      break;\n    }\n  }\n  return localMaximum;\n}\n/*\n * Builds a priority queue with part candidate positions for a specific image in\n * the batch. For this we find all local maxima in the score maps with score\n * values above a threshold. We create a single priority queue across all parts.\n */\nexport function buildPartWithScoreQueue(\n  scoreThreshold: number, localMaximumRadius: number,\n  scores: TensorBuffer3D): MaxHeap<PartWithScore> {\n  const [height, width, numKeypoints] = scores.shape;\n  const queue = new MaxHeap<PartWithScore>(\n    height * width *
```

```

numKeypoints, ({score}) => score);\n\n for (let heatmapY = 0; heatmapY < height; ++heatmapY) {\n  for (let
heatmapX = 0; heatmapX < width; ++heatmapX) {\n   for (let keypointId = 0; keypointId < numKeypoints;
++keypointId) {\n    const score = scores.get(heatmapY, heatmapX, keypointId);\n    // Only consider parts
with score greater or equal to threshold as\n    // root candidates.\n    if (score < scoreThreshold) {\n
continue;\n    }\n    // Only consider keypoints whose score is maximum in a local window.\n    if
(scoreIsMaximumInLocalWindow(\n      keypointId, score, heatmapY, heatmapX, localMaximumRadius,\n      scores)) {\n      queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});\n    }\n  }\n}\n}\n}\n\n return queue;\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\nimport {Keypoint,
PartWithScore, TensorBuffer3D, Vector2D} from './types';\nimport {clamp, getOffsetPoint} from './util';\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n  ([parentJoinName, childJoinName]): NumberTuple =>\n  ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\nparentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\nparentChildrenTuples.map(([\n  parentJointId,\n  ] =>\nparentJointId);\n\nfunction getDisplacement(\n  edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n  const numEdges = displacements.shape[2] / 2;\n  return {\n    y:
displacements.get(point.y, point.x, edgeId),\n    x: displacements.get(point.y, point.x, numEdges + edgeId)\n  };\n}\n\nfunction getStridedIndexNearPoint(\n  point: Vector2D, outputStride: number, height: number,\n  width:
number): Vector2D {\n  return {\n    y: clamp(Math.round(point.y / outputStride), 0, height - 1),\n    x:
clamp(Math.round(point.x / outputStride), 0, width - 1)\n  };\n}\n\n/**\n * We get a new keypoint along the
`edgeId` for the pose instance, assuming\n * that the position of the `idSource` part is already known. For this, we\n
* follow the displacement vector from the source to target part (stored in\n * the `i`-t channel of the displacement
tensor). The displaced keypoint\n * vector is refined using the offset vector by `offsetRefineStep` times.\n
*/\n\nfunction traverseToTargetKeypoint(\n  edgeId: number, sourceKeypoint: Keypoint, targetKeypointId:
number,\n  scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D, outputStride: number,\n  displacements:
TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n  const [height, width] = scoresBuffer.shape;\n  // Nearest
neighbor interpolation for the source->target displacements.\n  const sourceKeypointIndices =
getStridedIndexNearPoint(\n    sourceKeypoint.position, outputStride, height, width);\n  const displacement =\ngetDisplacement(edgeId, sourceKeypointIndices, displacements);\n  const displacedPoint =
addVectors(sourceKeypoint.position, displacement);\n  let targetKeypoint = displacedPoint;\n  for (let i = 0; i <
offsetRefineStep; i++) {\n    const targetKeypointIndices =\n      getStridedIndexNearPoint(targetKeypoint,
outputStride, height, width);\n    const offsetPoint = getOffsetPoint(\n      targetKeypointIndices.y,
targetKeypointIndices.x, targetKeypointId,\n      offsets);\n    targetKeypoint = addVectors(\n      {\n        x:
targetKeypointIndices.x * outputStride,\n        y: targetKeypointIndices.y * outputStride\n      },\n      {\n
x: offsetPoint.x, y: offsetPoint.y});\n  }\n  const targetKeypointIndices =\ngetStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n  const score = scoresBuffer.get(\n
targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);\n  return {position: targetKeypoint, part:
PART_NAMES[targetKeypointId], score};\n}\n\n/**\n * Follows the displacement fields to decode the full pose of
the object\n * instance given the position of a part that acts as root.\n *\n * @return An array of decoded keypoints
and their scores for a single pose\n */\n\nexport function decodePose(\n  root: PartWithScore, scores:

```

```

TensorBuffer3D, offsets: TensorBuffer3D,\n  outputStride: number, displacementsFwd: TensorBuffer3D,\n  displacementsBwd: TensorBuffer3D): Keypoint[] {\n  const numParts = scores.shape[2];\n  const numEdges =\n  parentToChildEdges.length;\n  const instanceKeypoints: Keypoint[] = new Array(numParts);\n  // Start a new\n  detection instance at the position of the root.\n  const {part: rootPart, score: rootScore} = root;\n  const rootPoint =\n  getImageCoords(rootPart, outputStride, offsets);\n  instanceKeypoints[rootPart.id] = {\n  score: rootScore,\n  part: PART_NAMES[rootPart.id],\n  position: rootPoint\n  };\n  // Decode the part positions upwards in the tree,\n  following the backward\n  // displacements.\n  for (let edge = numEdges - 1; edge >= 0; --edge) {\n  const\n  sourceKeypointId = parentToChildEdges[edge];\n  const targetKeypointId = childToParentEdges[edge];\n  if\n  (instanceKeypoints[sourceKeypointId] &&\n  !instanceKeypoints[targetKeypointId]) {\n  instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n  edge,\n  instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n  offsets, outputStride, displacementsBwd);\n  }\n  }\n  // Decode the part positions downwards in the tree, following the forward\n  // displacements.\n  for (let\n  edge = 0; edge < numEdges; ++edge) {\n  const sourceKeypointId = childToParentEdges[edge];\n  const\n  targetKeypointId = parentToChildEdges[edge];\n  if (instanceKeypoints[sourceKeypointId] &&\n  !instanceKeypoints[targetKeypointId]) {\n  instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n  edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n  offsets, outputStride,\n  displacementsFwd);\n  }\n  }\n  return instanceKeypoints;\n  }\n  }"/**\n  * @license\n  * Copyright 2019 Google\n  Inc. All Rights Reserved.\n  * Licensed under the Apache License, Version 2.0 (the "License");\n  * you may not\n  use this file except in compliance with the License.\n  * You may obtain a copy of the License at\n  *  

http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required by applicable law or agreed to in writing,\n  software\n  * distributed under the License is distributed on an "AS IS" BASIS,\n  * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for the specific language\n  governing permissions and\n  * limitations under the License.\n  *  

  =====\n  *\n  import { Keypoint, Pose, TensorBuffer3D } from '../types';\n  import { buildPartWithScoreQueue } from\n  './build_part_with_score_queue';\n  import { decodePose } from './decode_pose';\n  import { getImageCoords,\n  squaredDistance } from './util';\n  function withinNmsRadiusOfCorrespondingPoint(\n  poses: Pose[],\n  squaredNmsRadius: number, {x, y}: {x: number, y: number},\n  keypointId: number): boolean {\n  return\n  poses.some(({ keypoints }) => {\n  const correspondingKeypoint = keypoints[keypointId].position;\n  return\n  squaredDistance(\n  y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n  squaredNmsRadius;\n  });\n  }\n  /* Score the newly proposed object instance without taking into account\n  * the\n  scores of the parts that overlap with any previously detected\n  * instance.\n  */\n  function getInstanceScore(\n  existingPoses: Pose[], squaredNmsRadius: number,\n  instanceKeypoints: Keypoint[]): number {\n  let\n  notOverlappedKeypointScores = instanceKeypoints.reduce(\n  (result, { position, score }, keypointId): number =>\n  {\n  if (!withinNmsRadiusOfCorrespondingPoint(\n  existingPoses, squaredNmsRadius, position,\n  keypointId)) {\n  result += score;\n  }\n  return result;\n  }, 0.0);\n  return\n  notOverlappedKeypointScores / instanceKeypoints.length;\n  }\n  // A point (y, x) is considered as root part\n  candidate if its score is a\n  // maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n  //\n  kLocalMaximumRadius.\n  const kLocalMaximumRadius = 1;\n  /**\n  * Detects multiple poses and finds their parts\n  from part scores and\n  * displacement vectors. It returns up to `maxDetections` object instance\n  * detections in\n  decreasing root score order. It works as follows: We first\n  * create a priority queue with local part score maxima\n  above\n  * `scoreThreshold`, considering all parts at the same time. Then we\n  * iteratively pull the top element of\n  the queue (in decreasing score order)\n  * and treat it as a root candidate for a new object instance. To avoid\n  * duplicate detections, we reject the root candidate if it is within a disk\n  * of `nmsRadius` pixels from the\n  corresponding part of a previously detected\n  * instance, which is a form of part-based non-maximum suppression\n  (NMS). If\n  * the root candidate passes the NMS check, we start a new object instance\n  * detection, treating the\n  corresponding part as root and finding the\n  * positions of the remaining parts by following the displacement\n  vectors\n  * along the tree-structured part graph. We assign to the newly detected\n  * instance a score equal to the

```

sum of scores of its parts which have not been claimed by a previous instance (i.e., those at least `nmsRadius` pixels away from the corresponding part of all previously detected instances), divided by the total number of parts `numParts`. The value of `heatmapScores[y, x, k]` is the score of placing the `k`-th object part at position `(y, x)`. The value of `[offsets[y, x, k], offsets[y, x, k + numParts]]` is the short range offset vector of the `k`-th object part at heatmap position `(y, x)`. The value of `displacementsFwd` 3-D tensor of shape `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is the number of edges (parent-child pairs) in the tree. It contains the forward displacements between consecutive part from the root towards the leaves. The value of `displacementsBwd` 3-D tensor of shape `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is the number of edges (parent-child pairs) in the tree. It contains the backward displacements between consecutive part from the root towards the leaves. The value of `outputStride` The output stride that was used when feed-forwarding through the PoseNet model. Must be 32, 16, or 8. The value of `maxPoseDetections` Maximum number of returned instance detections per image. The value of `scoreThreshold` Only return instance detections that have root part score greater or equal to this value. Defaults to 0.5. The value of `nmsRadius` Non-maximum suppression part distance. It needs to be strictly positive. Two parts suppress each other if they are less than `nmsRadius` pixels away. Defaults to 20. The return value is an array of poses and their scores, each containing keypoints and the corresponding keypoint scores.

```

function decodeMultiplePoses(scoresBuffer: TensorBuffer3D,
offsetsBuffer: TensorBuffer3D,
displacementsFwdBuffer: TensorBuffer3D,
displacementsBwdBuffer:
TensorBuffer3D, outputStride: number,
maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20):
Pose[] {
  const poses: Pose[] = [];
  const queue = buildPartWithScoreQueue(scoreThreshold,
kLocalMaximumRadius, scoresBuffer);
  const squaredNmsRadius = nmsRadius * nmsRadius;
  // Generate at most maxDetections object instances per image in
  // decreasing root part score order.
  while (poses.length < maxPoseDetections && !queue.empty()) {
    // The top element in the queue is the next root candidate.
    const root = queue.dequeue();
    // Part-based non-maximum suppression: We reject a root candidate if it
    // is within a disk of nmsRadius pixels from the corresponding part of
    // a previously detected instance.
    const rootImageCoords =
      getImageCoords(root.part, outputStride, offsetsBuffer);
    if (withinNmsRadiusOfCorrespondingPoint(poses, squaredNmsRadius,
rootImageCoords, root.part.id)) {
      continue;
    }
    // Start a new detection instance at the position of the root.
    const keypoints =
      decodePose(root, scoresBuffer, offsetsBuffer, outputStride,
displacementsFwdBuffer,
displacementsBwdBuffer);
    const score = getInstanceScore(poses, squaredNmsRadius, keypoints);
    poses.push({keypoints, score});
  }
  return poses;
}

```

=====

```

import * as tf from 'tensorflow/tfjs-core';
import { BaseModel } from './base_model';
const imageNetMean = [-123.15, -115.90, -103.06];
export class ResNet extends BaseModel {
  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {
    return tf.add(input, imageNetMean);
  }
  nameOutputResults(results: tf.Tensor3D[]) {
    const [displacementBwd, displacementFwd, heatmap,
longOffsets, offsets, partHeatmaps, segmentation,
partOffsets] = results;
    return [offsets, segmentation, partHeatmaps, longOffsets, heatmap,
displacementFwd, displacementBwd, partOffsets];
  }
}

```

=====

```

import * as tf from 'tensorflow/tfjs-core';
import { BaseModel } from './base_model';
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    const [displacementBwd, displacementFwd, heatmap,
longOffsets, offsets, partHeatmaps, segmentation,
partOffsets] = results;
    return [offsets, segmentation, partHeatmaps, longOffsets, heatmap,
displacementFwd, displacementBwd, partOffsets];
  }
}

```

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```
=====
*\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/resnet50/';\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet/';\n\n// The BodyPix 2.0 ResNet50
models use the latest TensorFlow.js 1.0 model\n// format.\nexport function resNet50SavedModel(stride: number,
quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding
to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return RESNET50_BASE_URL +
`float` + graphJson;\n  } else {\n    return RESNET50_BASE_URL + `quant${quantBytes}` + graphJson;\n  }\n}\n\n// The BodyPix 2.0 MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport
function mobileNetSavedModel(\n  stride: number, multiplier: number, quantBytes: number): string {\n  const
toStr: {[key: number]: string} = {1.0: '100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-
stride${stride}.json`;\n  // quantBytes=4 corresponding to the non-quantized full-precision SavedModel.\n  if
(quantBytes === 4) {\n    return MOBILENET_BASE_URL + `float${toStr[multiplier]}` + graphJson;\n  } else
{\n    return MOBILENET_BASE_URL + `quant${quantBytes}/${toStr[multiplier]}` +\n      graphJson;\n  }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n * \n *
=====
```

```
*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {BodyPixInput, BodyPixOutputStride, Padding} from
 './types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from
 './types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\nHTMLCanvasElement|\n  OffscreenCanvas): [number, number] {\n  if ('offsetHeight' in input
&& input.offsetHeight !== 0\n    && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return
[input.offsetHeight, input.offsetWidth];\n  } else if (input.height !== null && input.width !== null) {\n    return
[input.height, input.width];\n  } else {\n    throw new Error(\n      `HTMLImageElement must have height and
width attributes set.`);\n  }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,
number] {\n  if (input.hasAttribute('height') && input.hasAttribute('width')) {\n    // Prioritizes user
specified height
and width.\n    // We can't test the .height and .width properties directly,\n    // because they evaluate to 0 if unset.\n    return [input.height, input.width];\n  } else {\n    return [input.videoHeight, input.videoWidth];\n  }\n}\n\nexport
function getInputSize(input: BodyPixInput): [number, number] {\n  if ((typeof (HTMLCanvasElement) !==
'undefined' &&\n    input instanceof HTMLCanvasElement) ||\n    (typeof (OffscreenCanvas) !== 'undefined'
&&\n    input instanceof OffscreenCanvas) ||\n    (typeof (HTMLImageElement) !== 'undefined' &&\n    input instanceof HTMLImageElement)) {\n    return
getSizeFromImageLikeElement(input);\n  } else if (typeof
(ImageData) !== 'undefined' && input instanceof ImageData) {\n    return [input.height, input.width];\n  }
else if (\n    typeof (HTMLVideoElement) !== 'undefined' && input instanceof HTMLVideoElement) {\n    return
getSizeFromVideoElement(input);\n  } else if (input instanceof tf.Tensor) {\n    return [input.shape[0],
input.shape[1]];\n  } else {\n    throw new Error(`error: Unknown input type: ${input}`);\n  }\n}\n\nfunction
isValidInputResolution(\n  resolution: number, outputStride: number): boolean {\n  return (resolution - 1) %
outputStride === 0;\n}\n\nexport function toValidInputResolution(\n  inputResolution: number, outputStride:
BodyPixOutputStride): number {\n  if (isValidInputResolution(inputResolution, outputStride)) {\n    return
inputResolution;\n  }\n  return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst
```

```

INTERNAL_RESOLUTION_STRING_OPTIONS = {\n low: 'low',\n medium: 'medium',\n high: 'high',\n full:
'full'\n};\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
[INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =
0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n
internalResolution: BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n    const
result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n\n    tf.util.assert(\n      typeof result
=== 'number',\n      () => `string value of inputResolution must be one of ${\n
Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n        .join(',')\n      } but was
${internalResolution}.`);\n    return result;\n  } else {\n    tf.util.assert(\n      typeof internalResolution === 'number'
&&\n      internalResolution <= MAX_INTERNAL_RESOLUTION &&\n      internalResolution >=
MIN_INTERNAL_RESOLUTION,\n      () =>\n        `inputResolution must be a string or number between ${\n
MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION}, but ` +\n        `was
${internalResolution}`);\n\n    return internalResolution;\n  }\n}\n\nexport function
toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n\n  return [\n
toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n    inputWidth * internalResolutionPercentage, outputStride)\n  ];\n}\n\nexport function
toInputTensor(input: BodyPixInput) {\n  // TODO: tf.browser.fromPixels types to support OffscreenCanvas\n //
@ts-ignore\n  return input instanceof tf.Tensor ? input : tf.browser.fromPixels(input);\n}\n\nexport function
resizeAndPadTo(\n  imageTensor: tf.Tensor3D, [targetH, targetW]: [number, number],\n  flipHorizontal = false):
{\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy: [[number, number], [number, number]]\n} {\n  const [height,
width] = imageTensor.shape;\n\n  const targetAspect = targetW / targetH;\n  const aspect = width / height;\n\n  let
resizeW: number;\n  let resizeH: number;\n  let padL: number;\n  let padR: number;\n  let padT: number;\n  let
padB: number;\n\n  if (aspect > targetAspect) {\n    // resize to have the larger dimension match the shape.\n
resizeW = targetW;\n    resizeH = Math.ceil(resizeW / aspect);\n\n    const padHeight = targetH - resizeH;\n    padL
= 0;\n    padR = 0;\n    padT = Math.floor(padHeight / 2);\n    padB = targetH - (resizeH + padT);\n  } else {\n
resizeH = targetH;\n    resizeW = Math.ceil(targetH * aspect);\n\n    const padWidth = targetW - resizeW;\n    padL
= Math.floor(padWidth / 2);\n    padR = targetW - (resizeW + padL);\n    padT = 0;\n    padB = 0;\n  }\n\n  const
resizedAndPadded = tf.tidy(() => {\n    // resize to have largest dimension match image\n    let resized:
tf.Tensor3D;\n    if (flipHorizontal) {\n      resized = tf.image.resizeBilinear(\n        tf.reverse(imageTensor, 1),
[resizeH, resizeW]);\n    } else {\n      resized = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n    }\n\n
const padded = tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);\n\n    return padded;\n  });\n\n  return
{resizedAndPadded, paddedBy: [[padT, padB], [padL, padR]]};\n}\n\nexport function
scaleAndCropToInputTensorShape(\n  tensor: tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number,
number],\n  [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL,
padR]]: [[number, number], [number, number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return
tf.tidy(() => {\n    let inResizedAndPadded: tf.Tensor3D = tf.image.resizeBilinear(tensor,\n
[resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n\n    if (applySigmoidActivation) {\n
inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n    }\n\n    return removePaddingAndResizeBack(\n
inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n      [[padT, padB], [padL, padR]]);\n
});\n}\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded: tf.Tensor3D,\n  [originalHeight,
originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number, number]]):\n
tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D = tf.expandDims(resizedAndPadded);\n
return tf.squeeze(tf.image\n      .cropAndResize(\n        batchedImage, [[\n          padT / (originalHeight +

```



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padT + padB - 1.0),\n          padL / (originalWidth + padL + padR - 1.0),\n          (padT + originalHeight - 1.0)
/\n          (originalHeight + padT + padB - 1.0),\n          (padL + originalWidth - 1.0) / (originalWidth + padL
+ padR - 1.0)\n          ]],\n          [0], [originalHeight, originalWidth]), [0]);\n });\n\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n  return
tf.tidy(() => {\n    const batchedImage: tf.Tensor4D = tf.expandDims(tensor, 2);\n    return tf.squeeze(\n      tf.image.resizeBilinear(batchedImage, resolution, nearestNeighbor));\n    });\n  }\n\n\nexport function
padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]: [number, number]):\n  {resized: tf.Tensor3D, padding: Padding} {\n    const [height, width] = getInputSize(input);\n    const targetAspect = targetW / targetH;\n    const aspect = width / height;\n    let [padT, padB, padL, padR] = [0, 0, 0, 0];\n    if (aspect < targetAspect) {\n      //
pads the width\n      padT = 0;\n      padB = 0;\n      padL = Math.round(0.5 * (targetAspect * height - width));\n      padR
= Math.round(0.5 * (targetAspect * height - width));\n    } else {\n      // pads the height\n      padT = Math.round(0.5 *
((1.0 / targetAspect) * width - height));\n      padB = Math.round(0.5 * ((1.0 / targetAspect) * width - height));\n
      padL = 0;\n      padR = 0;\n    }\n\n    const resized: tf.Tensor3D = tf.tidy(() => {\n      let imageTensor =
toInputTensor(input);\n      imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n\n      return
tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n    });\n\n    return {resized, padding: {top: padT, left: padL,\n      right: padR, bottom: padB}};\n  }\n\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n  Promise<TensorBuffer3D[]> {\n    return Promise.all(tensors.map(tensor => tensor.buffer()));\n  }\n\n\nexport function
scalePose(\n  pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n  offsetX = 0): Pose {\n    return {\n      score: pose.score,\n      keypoints: pose.keypoints.map(({score, part, position}) => ({\n
        score,\n        part,\n        position: {\n          x: position.x * scaleX +
offsetX,\n          y: position.y * scaleY + offsetY\n        }\n      })))\n    };\n  }\n\n\nexport function scalePoses(\n  poses: Pose[], scaleY: number, scaleX: number, offsetY = 0, offsetX
= 0) {\n    if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0) {\n      return poses;\n    }\n    return
poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n  }\n\n\nexport function
flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n    return {\n      score: pose.score,\n      keypoints:
pose.keypoints.map(\n        ({score, part, position}) => ({\n          score,\n          part,\n          position: {x:
imageWidth - 1 - position.x, y: position.y}\n        })\n      )\n    };\n  }\n\n\nexport function flipPosesHorizontal(poses: Pose[],
imageWidth: number) {\n    if (imageWidth <= 0) {\n      return poses;\n    }\n    return poses.map(pose =>
flipPoseHorizontal(pose, imageWidth));\n  }\n\n\nexport function scaleAndFlipPoses(\n  poses: Pose[], [height,
width]: [number, number],\n  [inputResolutionHeight, inputResolutionWidth]: [number, number],\n  padding:
Padding, flipHorizontal: boolean): Pose[] {\n    const scaleY =\n      (height + padding.top + padding.bottom) /
(inputResolutionHeight);\n    const scaleX =\n      (width + padding.left + padding.right) /
(inputResolutionWidth);\n\n    const scaledPoses =\n      scalePoses(poses, scaleY, scaleX, -padding.top, -
padding.left);\n\n    if (flipHorizontal) {\n      return flipPosesHorizontal(scaledPoses, width);\n    } else {\n      return
scaledPoses;\n    }\n  }\n\n\n", "\n**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport
{BaseModel} from './base_model';\nimport {decodeOnlyPartSegmentation, decodePartSegmentation,
toMaskTensor} from './decode_part_map';\nimport {MobileNet} from './mobilenet';\nimport
{decodePersonInstanceMasks, decodePersonInstancePartMasks} from
'/multi_person/decode_instance_masks';\nimport {decodeMultiplePoses} from
'/multi_person/decode_multiple_poses';\nimport {ResNet} from './resnet';\nimport {mobileNetSavedModel,

```

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resNet50SavedModel} from './saved_models';\nimport {BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding} from
 './types';\nimport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation} from './types';\nimport {getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D}
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n**\n * BodyPix model loading is configurable using the following config dictionary.\n *\n * `architecture`: BodyPixArchitecture. It determines which BodyPix architecture\n * to load. The supported
architectures are: MobileNetV1 and ResNet50.\n *\n * `outputStride`: Specifies the output stride of the BodyPix
model.\n * The smaller the value, the larger the output resolution, and more accurate\n * the model at the cost of
speed. Set this to a larger value to increase speed\n * at the cost of accuracy. Stride 32 is supported for ResNet and\n
* stride 8,16,32 are supported for various MobileNetV1 models.\n *\n * `multiplier`: An optional number with
values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by MobileNet architecture. It is the float\n * multiplier for
the depth (number of channels) for all convolution ops.\n * The larger the value, the larger the size of the layers, and
more accurate\n * the model at the cost of speed. Set this to a smaller value to increase speed\n * at the cost of
accuracy.\n *\n * `modelUrl`: An optional string that specifies custom url of the model. This\n * is useful for
area/countries that don't have access to the model hosted on\n * GCP.\n *\n * `quantBytes`: An optional number
with values: 1, 2, or 4. This parameter\n * affects weight quantization in the models. The available options are\n * 1
byte, 2 bytes, and 4 bytes. The higher the value, the larger the model size\n * and thus the longer the loading time,
the lower the value, the shorter the\n * loading time but lower the accuracy.\n */\n\nexport interface ModelConfig {\n
architecture: BodyPixArchitecture;\n outputStride: BodyPixOutputStride;\n multiplier?: BodyPixMultiplier;\n
modelUrl?: string;\n quantBytes?: BodyPixQuantBytes;}\n\n// The default configuration for loading
MobileNetV1 based BodyPix.\n\n// (And for references, the default configuration for loading ResNet\n// based
PoseNet is also included).\n\n// ``\n// const RESNET_CONFIG = {\n//   architecture: 'ResNet50',\n//
outputStride: 32,\n//   quantBytes: 4,\n// } as ModelConfig;\n// ``\n\nconst MOBILENET_V1_CONFIG = {\n
architecture: 'MobileNetV1',\n outputStride: 16,\n quantBytes: 4,\n multiplier: 0.75,\n} as ModelConfig;\n\nconst
VALID_ARCHITECTURE: BodyPixArchitecture[] = ['MobileNetV1', 'ResNet50'];\nconst VALID_STRIDE: {[id:
string]: BodyPixOutputStride[]} = {\n 'MobileNetV1': [8, 16, 32],\n 'ResNet50': [32, 16]};\n\nconst
VALID_MULTIPLIER: {[id: string]: BodyPixMultiplier[]} = {\n 'MobileNetV1': [0.50, 0.75, 1.0],\n 'ResNet50':
[1.0]};\n\nconst VALID_QUANT_BYTES: BodyPixQuantBytes[] = [1, 2, 4];\n\nfunction
validateModelConfig(config: ModelConfig): ModelConfig {\n  config = config || MOBILENET_V1_CONFIG;\n  if
(config.architecture == null) {\n    config.architecture = 'MobileNetV1';\n  }\n  if
(VALID_ARCHITECTURE.indexOf(config.architecture) < 0) {\n    throw new Error(\n      `Invalid architecture
${config.architecture}.` +\n      `Should be one of ${VALID_ARCHITECTURE}`);\n  }\n  if (config.outputStride
== null) {\n    config.outputStride = 16;\n  }\n  if
(VALID_STRIDE[config.architecture].indexOf(config.outputStride) < 0) {\n    throw new Error(\n      `Invalid
outputStride ${config.outputStride}.` +\n      `Should be one of ${VALID_STRIDE[config.architecture]}` +\n
`for architecture ${config.architecture}.`);\n  }\n  if (config.multiplier == null) {\n    config.multiplier = 1.0;\n
}\n  if (VALID_MULTIPLIER[config.architecture].indexOf(config.multiplier) < 0) {\n    throw new Error(\n
`Invalid multiplier ${config.multiplier}.` +\n      `Should be one of
${VALID_MULTIPLIER[config.architecture]}` +\n      `for architecture ${config.architecture}.`);\n  }\n  if
(config.quantBytes == null) {\n    config.quantBytes = 4;\n  }\n  if
(VALID_QUANT_BYTES.indexOf(config.quantBytes) < 0) {\n    throw new Error(\n      `Invalid quantBytes
${config.quantBytes}.` +\n      `Should be one of ${VALID_QUANT_BYTES}` +\n      `for architecture
${config.architecture}.`);\n  }\n  return config;\n}\n\n**\n * BodyPix inference is configurable using the
following config dictionary.\n *\n * `flipHorizontal`: If the left-right keypoint of poses/part segmentation\n * should
be flipped/mirrored horizontally. This should be set to true for\n * videos where the video is by default flipped
horizontally (i.e. a webcam),\n * and you want the person & body part segmentation to be returned in the proper\n
*
```

orientation.
`internalResolution`: Defaults to 'medium'. The internal resolution percentage that the input is resized to before inference. The larger the `internalResolution` the more accurate the model at the cost of slower prediction times. Available values are 'low', 'medium', 'high', 'full', or a percentage value between 0 and 1. The values 'low', 'medium', 'high', and 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.
`segmentationThreshold`: The minimum that segmentation values must have to be considered part of the person. Affects the generation of the segmentation mask. More specifically, it is the threshold used to binarize the intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the `segmentationThreshold`, it will be set to 1 otherwise 0.

```

export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?: BodyPixInternalResolution;
  segmentationThreshold?: number;
}
export interface PersonInferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
}
export interface MultiPersonInstanceInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
  minKeypointScore?: number;
  refineSteps?: number;
}
export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
};
export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiPersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10,
};
function validatePersonInferenceConfig(config: PersonInferenceConfig) {
  const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius } = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}`);
  }
}
function validateMultiPersonInstanceInferenceConfig(config: MultiPersonInstanceInferenceConfig) {
  const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius, minKeypointScore, refineSteps } = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}`);
  }
  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}. Should be in range [0.0, 1.0]`);
  }
  if (refineSteps <= 0 || refineSteps > 20) {
    throw new Error(`

```



```

padding.right]],\n      APPLY_SIGMOID_ACTIVATION);\n\n      return {\n        segmentation: toMaskTensor(\n          tf.squeeze(scaledSegmentScores), segmentationThreshold),\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        });\n    }\n  });\n  resized.dispose();\n  return {\n    segmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n  };\n}\n\n/**\n * Given an image with many people, returns a\n * PersonSegmentation dictionary\n * that contains the segmentation mask for all people and a single pose.\n *\n * Note: The segmentation mask returned by this method covers all people but\n * the pose works well for one person. If you want to estimate instance-level\n * multiple person segmentation & pose for each person, use\n * `segmentMultiPerson` instead.\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n *\n * @param config PersonInferenceConfig object that contains\n * parameters for the BodyPix inference using person decoding.\n *\n * @return A SemanticPersonSegmentation dictionary that contains height,\n * width, the flattened binary segmentation mask and the poses for all people.\n * The width and height correspond to the same dimensions of the input image.\n * - `height`: The height of the segmentation data in pixel unit.\n * - `width`: The width of the segmentation data in pixel unit.\n * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n * belongs to a person and 0 means the pixel doesn't belong to a person. The\n * size of the array is equal to `height` x `width` in row-major order.\n * - `allPoses`: The 2d poses of all people.\n */\n\nasync segmentPerson(\n  input: BodyPixInput,\n  config: PersonInferenceConfig =\n    PERSON_INFERENCE_CONFIG):\n  Promise<SemanticPersonSegmentation> {\n    config =\n      {...PERSON_INFERENCE_CONFIG, ...config};\n\n    validatePersonInferenceConfig(config);\n\n    const {\n      segmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      padding,\n      internalResolutionHeightAndWidth\n    } =\n      this.segmentPersonActivation(\n        input,\n        config.internalResolution, config.segmentationThreshold);\n\n    const [height, width] = segmentation.shape;\n\n    const result = await segmentation.data() as Uint8Array;\n    segmentation.dispose();\n\n    const tensorBuffers =\n      await toTensorBuffers3D(\n        [heatmapScores, offsets, displacementFwd, displacementBwd]);\n    const\n      [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n        tensorBuffers;\n\n    let poses =\n      decodeMultiplePoses(\n        scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n        this.baseModel.outputStride, config.maxDetections,\n        config.scoreThreshold, config.nmsRadius);\n\n    poses =\n      scaleAndFlipPoses(\n        poses, [height, width], internalResolutionHeightAndWidth, padding,\n        FLIP_POSES_AFTER_SCALING);\n\n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n\n    return {height, width, data: result, allPoses: poses};\n  }\n}\n\n/**\n * Given an image with multiple people, returns an *array* of\n * PersonSegmentation object. Each element in the array corresponding to one\n * of the people in the input image. In other words, it predicts\n * instance-level multiple person segmentation & pose for each person.\n *\n * The model does standard ImageNet pre-processing before inferring through\n * the model. The image pixels should have values [0-255].\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input\n * image to feed through the network.\n *\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for the BodyPix inference using multi-person decoding.\n *\n * @return An array of PersonSegmentation object, each containing a width,\n * height, a binary array (1 for the pixels that are part of the\n * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n * number of pixels in the image. The width and height correspond to the\n * dimensions of the image the binary array is shaped to, which are the same\n * dimensions of the input image.\n */\n\nasync segmentMultiPerson(\n  input: BodyPixInput,\n  config: MultiPersonInstanceInferenceConfig =\n    MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n  Promise<PersonSegmentation[]> {\n    config = { ...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n      ...config};\n\n    validateMultiPersonInstanceInferenceConfig(config);\n\n    const [height, width] =\n      getInputSize(input);\n\n    const internalResolutionHeightAndWidth =\n      toInputResolutionHeightAndWidth(\n        config.internalResolution, this.baseModel.outputStride,\n        [height, width]);\n\n    const {resized, padding} =\n      padAndResizeTo(input, internalResolutionHeightAndWidth);\n    const {\n      segmentation,\n      longOffsets,\n
```

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heatmapScoresRaw,\n  offsetsRaw,\n  displacementFwdRaw,\n  displacementBwdRaw,\n  } = tf.tidy(() =>
{\n  const {\n  segmentLogits,\n  longOffsets,\n  heatmapScores,\n  offsets,\n  displacementFwd,\n  displacementBwd,\n  } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n  const scaledSegmentScores =
scaleAndCropToInputTensorShape(\n  segmentLogits, [height, width], internalResolutionHeightAndWidth,\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n  APPLY_SIGMOID_ACTIVATION);\n  const longOffsetsResized = false;\n  let scaledLongOffsets;\n  if (longOffsetsResized) {\n  scaledLongOffsets = scaleAndCropToInputTensorShape(\n  longOffsets, [height, width],
internalResolutionHeightAndWidth,\n  [[padding.top, padding.bottom], [padding.left, padding.right]],\n  APPLY_SIGMOID_ACTIVATION);\n  } else {\n  scaledLongOffsets = longOffsets;\n  }\n  const
segmentation = toMaskTensor(\n  tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n  return {\n  segmentation,\n  longOffsets: scaledLongOffsets,\n  heatmapScoresRaw: heatmapScores,\n  offsetsRaw: offsets,\n  displacementFwdRaw: displacementFwd,\n  displacementBwdRaw:
displacementBwd,\n  };\n  });\n  const tensorBuffers = await toTensorBuffers3D(\n  [heatmapScoresRaw,
offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf] =\n  tensorBuffers;\n  let poses = decodeMultiplePoses(\n
scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n  this.baseModel.outputStride,
config.maxDetections,\n  config.scoreThreshold, config.nmsRadius);\n  poses = scaleAndFlipPoses(\n
poses, [height, width], internalResolutionHeightAndWidth, padding,\n  FLIP_POSES_AFTER_SCALING);\n  const instanceMasks = await decodePersonInstanceMasks(\n
segmentation, longOffsets, poses, height, width,\n  this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n  config.scoreThreshold,
config.refineSteps, config.minKeypointScore,\n  config.maxDetections);\n  resized.dispose();\n
segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n
displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  return instanceMasks;\n  };\n  /**\n  *
Given an image with many people, returns a dictionary containing: height,\n  * width, a tensor with a part id from 0-
24 for the pixels that are\n  * part of a corresponding body part, and -1 otherwise. This does standard\n  * ImageNet
pre-processing before inferring through the model. The image\n  * should pixels should have values [0-255].\n  * \n
* @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n  * The input
image to feed through the network.\n  * \n  * @param internalResolution Defaults to 'medium'. The internal
resolution\n  * percentage that the input is resized to before inference. The larger the\n  * internalResolution
the more accurate the model at the cost of slower\n  * prediction times. Available values are 'low', 'medium', 'high',
'full', or\n  * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n  * 'full' map to 0.25, 0.5,
0.75, and 1.0 correspondingly.\n  * \n  * @param segmentationThreshold The minimum that segmentation values
must have\n  * to be considered part of the person. Affects the clipping of the colored\n  * part image.\n  * \n
* @return A dictionary containing `partSegmentation`, `heatmapScores`,\n  * `offsets`, and `padding`:\n  * -
`partSegmentation`: A 2d Tensor with a part id from 0-24 for\n  * the pixels that are part of a corresponding body
part, and -1 otherwise.\n  * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n  * single-person
pose estimation decoding.\n  * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n  *
estimation decoding.\n  * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n  * used by
pose estimation decoding.\n  * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n  *
by pose estimation decoding.\n  * - `padding`: The padding (unit pixels) being applied to the input image\n  *
before it is fed into the model.\n  * \n  */\n  segmentPersonPartsActivation(\n  input: BodyPixInput,\n
internalResolution: BodyPixInternalResolution,\n  segmentationThreshold = 0.5): {\n  partSegmentation:
tf.Tensor2D,\n  heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n
displacementBwd: tf.Tensor3D,\n  padding: Padding,\n  internalResolutionHeightAndWidth: [number, number]\n
} {\n  const [height, width] = getInputSize(input);\n  const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(\n  internalResolution, this.baseModel.outputStride, [height, width]);\n
const {\n  resized,\n  padding,\n  } = padAndResizeTo(input, internalResolutionHeightAndWidth);\n  const

```

```

{\n partSegmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } =
tf.tidy(() => {\n const {\n segmentLogits,\n partHeatmapLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = this.predictForPersonSegmentationAndPart(resized);\n\n const [resizedHeight, resizedWidth] = resized.shape;\n\n const scaledSegmentScores =
scaleAndCropToInputTensorShape(\n segmentLogits, [height, width], [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n\n const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n partHeatmapLogits, [height, width],\n [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n\n const segmentation =\n toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n\n return {\n partSegmentation:\n decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };
\n });
\n resized.dispose();
\n return {\n partSegmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n };
\n }
\n\n /**
\n * Given an image with many people,
\n returns a PartSegmentation dictionary that
\n * contains the body part segmentation mask for all people and a single
\n pose.
\n *
\n * Note: The body part segmentation mask returned by this method covers all
\n * people but the pose
\n works well when there is one person. If you want to
\n * estimate instance-level multiple person body part
\n segmentation & pose for
\n * each person, use `segmentMultiPersonParts` instead.
\n *
\n * @param input
\n ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)
\n * The input image to feed
\n through the network.
\n *
\n * @param config PersonInferenceConfig object that contains
\n * parameters for the
\n BodyPix inference using single person decoding.
\n *
\n * @return A SemanticPartSegmentation dictionary that
\n contains height, width,
\n * the flattened binary segmentation mask and the pose for the person. The
\n * width and
\n height correspond to the same dimensions of the input image.
\n *
\n * - `height`: The height of the person part
\n segmentation data in pixel unit.
\n *
\n * - `width`: The width of the person part segmentation data in pixel unit.
\n *
\n * -
\n `data`: The flattened Int32Array of person part segmentation data with a
\n * part id from 0-24 for the pixels that are
\n part of a corresponding body
\n * part, and -1 otherwise. The size of the array is equal to `height` x
\n * `width` in
\n row-major order.
\n *
\n * - `allPoses`: The 2d poses of all people.
\n */
\n async segmentPersonParts(\n input:
\n BodyPixInput,\n config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):
\n Promise<SemanticPartSegmentation> {\n config = {...PERSON_INFERENCE_CONFIG, ...config};\n\n
\n validatePersonInferenceConfig(config);\n\n const {\n partSegmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n internalResolutionHeightAndWidth\n } =\n this.segmentPersonPartsActivation(\n input, config.internalResolution, config.segmentationThreshold);\n\n
\n const [height, width] = partSegmentation.shape;\n\n const data = await partSegmentation.data() as Int32Array;\n\n
\n partSegmentation.dispose();\n\n const tensorBuffers = await toTensorBuffers3D(\n [heatmapScores, offsets,\n displacementFwd, displacementBwd]);\n\n const [scoresBuf, offsetsBuf, displacementsFwdBuf,\n displacementsBwdBuf] =\n tensorBuffers;\n\n let poses = decodeMultiplePoses(\n scoresBuf, offsetsBuf,\n displacementsFwdBuf, displacementsBwdBuf,\n this.baseModel.outputStride, config.maxDetections,\n config.scoreThreshold, config.nmsRadius);\n\n poses = scaleAndFlipPoses(\n poses, [height, width],\n internalResolutionHeightAndWidth, padding,\n FLIP_POSES_AFTER_SCALING);\n\n heatmapScores.dispose();\n offsets.dispose();\n displacementFwd.dispose();\n displacementBwd.dispose();\n\n
\n return {height, width, data, allPoses: poses};
\n }
\n\n /**
\n * Given an image with multiple people, returns an
\n *array* of PartSegmentation
\n * object. Each element in the array corresponding to one
\n * of the people in the
\n input image. In other words, it predicts
\n * instance-level multiple person body part segmentation & pose for
\n each
\n * person.
\n *
\n * This does standard ImageNet pre-processing before inferring through
\n * the model.
\n The image pixels should have values [0-255].
\n *
\n * @param input
\n *
\n ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input
\n * image to feed
\n through the network.
\n *
\n * @param config MultiPersonInferenceConfig object that contains
\n * parameters for the
\n BodyPix inference using multi-person decoding.
\n *
\n * @return An array of PartSegmentation object, each

```

containing a width, height, a flattened array (with part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise) and 2D pose. The width and height correspond to the dimensions of the image. Each flattened part segmentation array size is equal to height x width.

```

async
segmentMultiPersonParts(
  input: BodyPixInput,
  config: MultiPersonInstanceInferenceConfig = MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {
  config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};
  validateMultiPersonInstanceInferenceConfig(config);
  const [height, width] = getInputSize(input);
  const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(
    config.internalResolution,
    this.baseModel.outputStride,
    [height, width]);
  const {resized, padding} = padAndResizeTo(input,
    internalResolutionHeightAndWidth);
  const {segmentation, longOffsets, heatmapScoresRaw, offsetsRaw,
    displacementFwdRaw, displacementBwdRaw, partSegmentation, } = tf.tidy(() => {
    const {segmentLogits, longOffsets, heatmapScores, offsets,
    displacementFwd, displacementBwd, partHeatmaps} =
    this.predictForMultiPersonInstanceSegmentationAndPart(resized);
    // decoding with scaling
    const scaledSegmentScores = scaleAndCropToInputTensorShape(
      segmentLogits, [height, width],
      internalResolutionHeightAndWidth,
      [[padding.top, padding.bottom], [padding.left, padding.right]],
      APPLY_SIGMOID_ACTIVATION);
    // decoding with scaling
    const scaledPartSegmentationScores =
    scaleAndCropToInputTensorShape(
      partHeatmaps, [height, width], internalResolutionHeightAndWidth,
      [[padding.top, padding.bottom], [padding.left, padding.right]],
      APPLY_SIGMOID_ACTIVATION);
    const scaledLongOffsets = longOffsets;
    const segmentation = toMaskTensor(
    tf.squeeze(scaledSegmentScores), config.segmentationThreshold);
    const partSegmentation =
    decodeOnlyPartSegmentation(scaledPartSegmentationScores);
    return {segmentation, longOffsets:
    scaledLongOffsets, heatmapScoresRaw: heatmapScores,
    offsetsRaw: offsets, displacementFwdRaw: displacementFwd,
    displacementBwdRaw: displacementBwd, partSegmentation};
  });
  const tensorBuffers = await toTensorBuffers3D(
    [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);
  const [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =
    tensorBuffers;
  let poses = decodeMultiplePoses(
    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
    this.baseModel.outputStride, config.maxDetections,
    config.scoreThreshold, config.nmsRadius);
  poses = scaleAndFlipPoses(
    poses, [height, width], internalResolutionHeightAndWidth, padding,
    FLIP_POSES_AFTER_SCALING);
  const instanceMasks = await decodePersonInstancePartMasks(
    segmentation, longOffsets, partSegmentation, poses, height, width,
    this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,
    config.scoreThreshold, config.refineSteps, config.minKeypointScore,
    config.maxDetections);
  resized.dispose();
  segmentation.dispose();
  longOffsets.dispose();
  heatmapScoresRaw.dispose();
  offsetsRaw.dispose();
  displacementFwdRaw.dispose();
  displacementBwdRaw.dispose();
  partSegmentation.dispose();
  return instanceMasks;
}

public dispose() {
  this.baseModel.dispose();
}
}

/**
 * Loads the MobileNet BodyPix model.
 */
async function loadMobileNet(config: ModelConfig):
Promise<BodyPix> {
  const outputStride = config.outputStride;
  const quantBytes = config.quantBytes;
  const multiplier = config.multiplier;
  if (tf == null) {
    throw new Error(
      `Cannot find TensorFlow.js. If you are using a <script> tag, please `
      + `also include @tensorflow/tfjs on the page before using this
      model.`);
  }
  const url = mobileNetSavedModel(outputStride, multiplier, quantBytes);
  const graphModel = await tfconv.loadGraphModel(
    config.modelUrl || url);
  const mobilenet = new MobileNet(graphModel, outputStride);
  return new BodyPix(mobilenet);
}

/**
 * Loads the ResNet BodyPix model.
 */
async function loadResNet(config: ModelConfig):
Promise<BodyPix> {
  const outputStride = config.outputStride;
  const quantBytes = config.quantBytes;
  if (tf == null) {
    throw new Error(
      `Cannot find TensorFlow.js. If you are using a <script> tag, please `
      + `also include @tensorflow/tfjs on the page before using this
      model.`);
  }
  const url = resNet50SavedModel(outputStride, quantBytes);
  const graphModel = await tfconv.loadGraphModel(
    config.modelUrl || url);
  const resnet = new ResNet(graphModel, outputStride);
  return

```


new BodyPix(resnet);\n\n/**\n * Loads the BodyPix model instance from a checkpoint, with the ResNet\n * or MobileNet architecture. The model to be loaded is configurable using the\n * config dictionary ModelConfig. Please find more details in the\n * documentation of the ModelConfig.\n *\n * @param config ModelConfig dictionary that contains parameters for\n * the BodyPix loading process. Please find more details of each parameters\n * in the documentation of the ModelConfig interface. The predefined\n * `MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n * for defining your customized config.\n */\nexport async function load(config: ModelConfig = MOBILENET_V1_CONFIG): Promise<BodyPix> {\n config = validateModelConfig(config);\n if (config.architecture === 'ResNet50') {\n return loadResNet(config);\n } else if (config.architecture === 'MobileNetV1') {\n return loadMobileNet(config);\n } else {\n return null;\n }\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```

=====
*\n\n// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQe\nexport function cpuBlur(\n  canvas: HTMLCanvasElement|OffscreenCanvas,\n  image:\n  HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n  blur: number) {\n  const ctx = canvas.getContext('2d');\n  let sum = 0;\n  const delta = 5;\n  const alphaLeft = 1 / (2 * Math.PI * delta * delta);\n  const step = blur < 3 ? 1 : 2;\n  for (let y = -blur; y <= blur; y += step) {\n    for (let x = -blur; x <= blur; x += step) {\n      const weight =\n        alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n      sum += weight;\n    }\n  }\n  for (let y = -blur; y <= blur; y += step) {\n    for (let x = -blur; x <= blur; x += step) {\n      ctx.globalAlpha = alphaLeft *\n        Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n      ctx.drawImage(image, x, y);\n    }\n  }\n  ctx.globalAlpha = 1;\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====
*\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize} from './util';\n\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:\n  {[name: string]: Canvas} = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype HasDimensions = {\n  width: number,\n  height: number\n};\n\nfunction isSafari() {\n  return\n    (/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n  {width: widthA, height: heightA}: HasDimensions,\n  {width: widthB, height: heightB}: HasDimensions, nameA: string,\n  nameB: string) {\n  if (widthA !== widthB || heightA !== heightB) {\n    throw new Error(`error: dimensions must match. ${nameA} has dimensions ${\n      widthA}x${heightA}, ${nameB} has dimensions\n      ${widthB}x${heightB}`);\n  }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n  const ctx = canvas.getContext('2d');\n  ctx.scale(-1, 1);\n  ctx.translate(-canvas.width, 0);\n}\n\nfunction drawWithCompositing(\n  ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n  image: Canvas|ImageType,\n  compositeOperation: string) {\n  ctx.globalCompositeOperation = compositeOperation;\n  ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n  if (typeof document !== 'undefined') {\n    return document.createElement('canvas');\n  } else if (typeof OffscreenCanvas !== 'undefined') {\n    return new OffscreenCanvas(0, 0);\n  } else {\n    throw new Error('Cannot create a canvas in this context');\n  }\n}

```

```

}\n\nfunction ensureOffscreenCanvasCreated(id: string): Canvas {\n if (!offScreenCanvases[id]) {\n
offScreenCanvases[id] = createOffScreenCanvas();\n }\n return offScreenCanvases[id];\n}\n\nfunction
drawAndBlurImageOnCanvas(\n image: ImageType, blurAmount: number, canvas: Canvas) {\n const {height,
width} = image;\n const ctx = canvas.getContext('2d');\n canvas.width = width;\n canvas.height = height;\n
ctx.clearRect(0, 0, width, height);\n ctx.save();\n if (isSafari()) {\n cpuBlur(canvas, image, blurAmount);\n } else
{\n // tslint:disable:no-any\n (ctx as any).filter = `blur(${blurAmount}px)`;\n ctx.drawImage(image, 0, 0,
width, height);\n }\n ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n image: ImageType,
blurAmount: number,\n offscreenCanvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(offscreenCanvasName);\n if (blurAmount === 0) {\n
renderImageToCanvas(image, canvas);\n } else {\n drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n
}\n return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n const {width,
height} = image;\n canvas.width = width;\n canvas.height = height;\n const ctx = canvas.getContext('2d');\n\n
ctx.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\nfunction
renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n canvas.width = image.width;\n canvas.height
= image.height;\n const ctx = canvas.getContext('2d');\n\n ctx.putImageData(image, 0, 0);\n}\n\nfunction
renderImageDataToOffScreenCanvas(\n image: ImageData, canvasName: string): Canvas {\n const canvas =
ensureOffscreenCanvasCreated(canvasName);\n renderImageDataToCanvas(image, canvas);\n\n return
canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with
foreground and background color at each pixel determined by the\n * corresponding binary segmentation value at
the pixel from the output. In\n * other words, pixels where there is a person will be colored with foreground\n *
color and where there is not a person will be colored with background color.\n */\n * @param
personOrPartSegmentation The output from\n * `segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts`
or `segmentMultiPersonParts`. They can\n * be SemanticPersonSegmentation object, an array of
PersonSegmentation object,\n * SemanticPartSegmentation object, or an array of PartSegmentation object.\n */\n *
@param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground color\n * (r,g,b,a) for visualizing pixels that
belong to people.\n */\n * @param background Default to {r:0, g:0, b:0, a: 255}. The background color\n * (r,g,b,a)
for visualizing pixels that don't belong to people.\n */\n * @param drawContour Default to false. Whether to draw
the contour around each\n * person's segmentation mask or body part mask.\n */\n * @param foregroundIds Default
to [1]. The integer values that represent\n * foreground. For person segmentation, 1 is the foreground. For body
part\n * segmentation, it can be a subset of all body parts ids.\n */\n * @returns An ImageData with the same width
and height of\n * all the PersonSegmentation in multiPersonSegmentation, with opacity and\n * transparency at each
pixel determined by the corresponding binary\n * segmentation value at the pixel from the output.\n */\n\nexport
function toMask(\n personOrPartSegmentation: SemanticPersonSegmentation|\n
SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n foreground: Color = {\n r: 0,\n g:
0,\n b: 0,\n a: 0\n },\n background: Color = {\n r: 0,\n g: 0,\n b: 0,\n a: 255\n },\n
drawContour = false, foregroundIds: number[] = [1]): ImageData {\n if (Array.isArray(personOrPartSegmentation)
&&\n personOrPartSegmentation.length === 0) {\n return null;\n }\n\n let multiPersonOrPartSegmentation:\n
Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n
PersonSegmentation|PartSegmentation>;\n\n if (!Array.isArray(personOrPartSegmentation)) {\n
multiPersonOrPartSegmentation = [personOrPartSegmentation];\n } else {\n multiPersonOrPartSegmentation =
personOrPartSegmentation;\n }\n\n const {width, height} = multiPersonOrPartSegmentation[0];\n const bytes =
new Uint8ClampedArray(width * height * 4);\n\n function drawStroke(\n bytes: Uint8ClampedArray, row:
number, column: number, width: number,\n radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {\n
for (let i = -radius; i <= radius; i++) {\n for (let j = -radius; j <= radius; j++) {\n if (i !== 0 && j !== 0) {\n
const n = (row + i) * width + (column + j);\n bytes[4 * n + 0] = color.r;\n bytes[4 * n + 1] = color.g;\n
bytes[4 * n + 2] = color.b;\n bytes[4 * n + 3] = color.a;\n }\n }\n }\n }\n\n function
isSegmentationBoundary(\n segmentationData: Uint8Array|Int32Array,\n row: number,\n column:
number,\n width: number,\n foregroundIds: number[] = [1],\n radius = 1,\n ): boolean {\n let

```

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numberBackgroundPixels = 0;\n  for (let i = -radius; i <= radius; i++) {\n    for (let j = -radius; j <= radius; j++)\n    {\n      if (i !== 0 && j !== 0) {\n        const n = (row + i) * width + (column + j);\n        if\n        (!foregroundIds.some(id => id === segmentationData[n])) {\n          numberBackgroundPixels += 1;\n        }\n      }\n    }\n  }\n  return numberBackgroundPixels > 0;\n }\n\n for (let i = 0; i < height; i += 1) {\n  for (let j = 0; j\n  < width; j += 1) {\n    const n = i * width + j;\n    bytes[4 * n + 0] = background.r;\n    bytes[4 * n + 1] =\n    background.g;\n    bytes[4 * n + 2] = background.b;\n    bytes[4 * n + 3] = background.a;\n    for (let k = 0; k <\n    multiPersonOrPartSegmentation.length; k++) {\n      if (foregroundIds.some(\n        id => id ===\n        multiPersonOrPartSegmentation[k].data[n])) {\n        bytes[4 * n] = foreground.r;\n        bytes[4 * n + 1] =\n        foreground.g;\n        bytes[4 * n + 2] = foreground.b;\n        bytes[4 * n + 3] = foreground.a;\n        const\n        isBoundary = isSegmentationBoundary(\n          multiPersonOrPartSegmentation[k].data, i, j, width,\n          foregroundIds);\n        if (drawContour && i - 1 >= 0 && i + 1 < height && j - 1 >= 0 &&\n          j + 1 < width\n          && isBoundary) {\n          drawStroke(bytes, i, j, width, 1);\n        }\n      }\n    }\n  }\n}\n\n return new\nImageData(bytes, width, height);\n}\n\nconst RAINBOW_PART_COLORS: Array<[number, number, number]> =\n[\n  [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167],\n  [238, 67, 149], [255, 78, 125], [255, 94, 99],\n  [255, 115, 75],\n  [255, 140, 56], [239, 167, 47], [217, 194, 49], [194, 219, 64],\n  [175, 240, 91], [135, 245, 87],\n  [96, 247, 96], [64, 243, 115],\n  [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213],\n  [47, 150, 224], [65,\n  125, 224], [84, 101, 214], [99, 81, 195]\n];\n\n/**\n * Given the output from person body part segmentation (or\n * multi-person\n * instance body part segmentation) and an array of colors indexed by part id,\n * generates an image\n * with the corresponding color for each part at each pixel,\n * and white pixels where there is no part.\n */\n * @param\n * partSegmentation The output from segmentPersonParts\n * or segmentMultiPersonParts. The former is a\n * SemanticPartSegmentation\n * object and later is an array of PartSegmentation object.\n */\n * @param partColors A\n * multi-dimensional array of rgb colors indexed by\n * part id. Must have 24 colors, one for every part.\n */\n * @returns An ImageData with the same width and height of all the element in\n * multiPersonPartSegmentation,\n * with the corresponding color for each part at\n * each pixel, and black pixels where there is no part.\n */\n\nexport\nfunction toColoredPartMask(\n  partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n  partColors:\n  Array<[number, number, number]> =\n  RAINBOW_PART_COLORS): ImageData {\n  if\n  (Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n    return null;\n  }\n\n  let\n  multiPersonPartSegmentation;\n  if (!Array.isArray(partSegmentation)) {\n    multiPersonPartSegmentation =\n    [partSegmentation];\n  } else {\n    multiPersonPartSegmentation = partSegmentation;\n  }\n\n  const {width, height}\n  = multiPersonPartSegmentation[0];\n  const bytes = new Uint8ClampedArray(width * height * 4);\n  for (let i = 0;\n  i < height * width; ++i) {\n    // invert mask. Invert the segmentation mask.\n    const j = i * 4;\n    bytes[j + 0] =\n    255;\n    bytes[j + 1] = 255;\n    bytes[j + 2] = 255;\n    bytes[j + 3] = 255;\n    for (let k = 0; k <\n    multiPersonPartSegmentation.length; k++) {\n      const partId = multiPersonPartSegmentation[k].data[i];\n      if\n      (partId !== -1) {\n        const color = partColors[partId];\n        if (!color) {\n          throw new Error(`No color could\n          be found for part id ${partId}`);\n        }\n        bytes[j + 0] = color[0];\n        bytes[j + 1] = color[1];\n        bytes[j +\n        2] = color[2];\n        bytes[j + 3] = 255;\n      }\n    }\n  }\n  return new ImageData(bytes, width, height);\n}\n\nconst\nCANVAS_NAMES = {\n  blurred: 'blurred',\n  blurredMask: 'blurred-mask',\n  mask: 'mask',\n  lowresPartMask:\n  'lowres-part-mask',\n};\n\n/**\n * Given an image and a maskImage of type ImageData, draws the image with the\n * mask on top of it onto a canvas.\n */\n * @param canvas The canvas to be drawn onto.\n */\n * @param image The\n * original image to apply the mask to.\n */\n * @param maskImage An ImageData containing the mask. Ideally this\n * should be\n * generated by toMask or toColoredPartMask.\n */\n * @param maskOpacity The opacity of the mask\n * when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n */\n * @param\n * maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * Should be an integer between 0 and 20.\n */\n * @param\n * flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n */\n\nexport\nfunction\n drawMask(\n  canvas: Canvas, image: ImageType, maskImage: ImageData|null,\n  maskOpacity = 0.7,\n  maskBlurAmount = 0, flipHorizontal = false) {\n  const [height, width] =\n  getInputSize(image);\n  canvas.width =\n  width;\n  canvas.height = height;\n  const ctx =\n  canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n  ctx.drawImage(image, 0, 0);\n  ctx.globalAlpha =\n  maskOpacity;\n  if

```

```

(maskImage) {\n  assertSameDimensions({ width, height}, maskImage, 'image', 'mask');\n\n  const mask =
renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n  const blurredMask =
drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount, CANVAS_NAMES.blurredMask);\n  ctx.drawImage(blurredMask, 0, 0, width, height);\n  }\n  ctx.restore();\n}\n\n/**\n * Given an image and a
maskImage of type ImageData, draws the image with the\n * pixelated mask on top of it onto a canvas.\n *\n * @param canvas The canvas to be drawn onto.\n *\n * @param image The original image to apply the mask to.\n *\n * @param maskImage An ImageData containing the mask. Ideally this should be\n * generated by
toColoredPartMask.\n *\n * @param maskOpacity The opacity of the mask when drawing it on top of the\n *
image. Defaults to 0.7. Should be a float between 0 and 1.\n *\n * @param maskBlurAmount How many pixels to
blur the mask by. Defaults to 0.\n *\n * Should be an integer between 0 and 20.\n *\n * @param flipHorizontal If the
result should be flipped horizontally. Defaults\n * to false.\n *\n * @param pixelCellWidth The width of each pixel
cell. Default to 10 px.\n */\nexport function drawPixelatedMask(\n  canvas: Canvas, image: ImageType,
maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth =
10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({ width, height}, maskImage,
'image', 'mask');\n\n  const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n  const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount,
CANVAS_NAMES.blurredMask);\n\n  canvas.width = blurredMask.width;\n  canvas.height =
blurredMask.height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n\n  const offscreenCanvas =\n  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =
offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n  offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n    blurredMask, 0, 0, blurredMask.width, blurredMask.height, 0, 0,\n    offscreenCanvas.width,
offscreenCanvas.height);\n  ctx.imageSmoothingEnabled = false;\n  ctx.drawImage(\n    offscreenCanvas, 0, 0,
offscreenCanvas.width, offscreenCanvas.height, 0, 0, canvas.width, canvas.height);\n\n  // Draws vertical grid
lines that are `pixelCellWidth` apart from each other.\n  for (let i = 0; i < offscreenCanvas.width; i++) {\n    ctx.beginPath();\n    ctx.strokeStyle = '#ffffff';\n    ctx.moveTo(pixelCellWidth * i, 0);\n    ctx.lineTo(pixelCellWidth
* i, canvas.height);\n    ctx.stroke();\n  }\n\n  // Draws horizontal grid lines that are `pixelCellWidth` apart from
each\n  // other.\n  for (let i = 0; i < offscreenCanvas.height; i++) {\n    ctx.beginPath();\n    ctx.strokeStyle =
'#ffffff';\n    ctx.moveTo(0, pixelCellWidth * i);\n    ctx.lineTo(canvas.width, pixelCellWidth * i);\n    ctx.stroke();\n  }\n\n  ctx.globalAlpha = 1.0 - maskOpacity;\n  ctx.drawImage(image, 0, 0, blurredMask.width,
blurredMask.height);\n  ctx.restore();\n}\n\nfunction createPersonMask(\n  multiPersonSegmentation:
PersonSegmentation[]|SemanticPersonSegmentation,\n  edgeBlurAmount: number): Canvas {\n  const
backgroundMaskImage = toMask(\n    multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},\n    {r: 0, g: 0, b: 0, a:
0});\n\n  const backgroundMask =\n    renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n    return backgroundMask;\n  } else {\n    return
drawAndBlurImageOnOffScreenCanvas(\n    backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred
image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param
personSegmentation A SemanticPersonSegmentation or an array of\n * PersonSegmentation object.\n *\n * @param
backgroundBlurAmount How many pixels in the background blend into each\n * other. Defaults to 3. Should be an
integer between 1 and 20.\n *\n * @param edgeBlurAmount How many pixels to blur on the edge between the
person\n * and the background by. Defaults to 3. Should be an integer between 0 and 20.\n *\n * @param
flipHorizontal If the output should be flipped horizontally. Defaults\n * to false.\n */\nexport function
drawBokehEffect(\n  canvas: Canvas, image: ImageType,\n  multiPersonSegmentation:
SemanticPersonSegmentation|PersonSegmentation[],\n  backgroundBlurAmount = 3, edgeBlurAmount = 3,
flipHorizontal = false) {\n  const blurredImage = drawAndBlurImageOnOffScreenCanvas(\n    image,

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backgroundBlurAmount, CANVAS_NAMES.blurred);\n canvas.width = blurredImage.width;\n canvas.height =
blurredImage.height;\n\n const ctx = canvas.getContext('2d');\n\n if (Array.isArray(multiPersonSegmentation)
&&\n  multiPersonSegmentation.length === 0) {\n  ctx.drawImage(blurredImage, 0, 0);\n  return;\n }\n\n const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);\n\n ctx.save();\n if
(flipHorizontal) {\n  flipCanvasHorizontal(canvas);\n }\n // draw the original image on the final canvas\n const
[height, width] = getInputSize(image);\n ctx.drawImage(image, 0, 0, width, height);\n\n // \"destination-in\" - \"The
existing canvas content is kept where both the\n // new shape and existing canvas content overlap. Everything else
is made\n // transparent.\"\n // crop what's not the person using the mask from the original image\n
drawWithCompositing(ctx, personMask, 'destination-in');\n // \"destination-over\" - \"The existing canvas content is
kept where both the\n // new shape and existing canvas content overlap. Everything else is made\n //
transparent.\"\n // draw the blurred background on top of the original image where it doesn't\n // overlap.\n
drawWithCompositing(ctx, blurredImage, 'destination-over');\n ctx.restore();\n}\n\nfunction
createBodyPartMask(\n  multiPersonPartSegmentation: SemanticPartSegmentation|PartSegmentation[],\n
bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {\n  const backgroundMaskImage = toMask(\n
  multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},\n    {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);\n
const backgroundMask =\n  renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);\n  if (edgeBlurAmount === 0) {\n    return backgroundMask;\n  } else {\n    return
drawAndBlurImageOnOffScreenCanvas(\n    backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);\n  }\n}\n\n/**\n * Given a personSegmentation and an image, draws the image
with its background\n * blurred onto the canvas.\n *\n * @param canvas The canvas to draw the background-blurred
image onto.\n *\n * @param image The image to blur the background of and draw.\n *\n * @param
partSegmentation A SemanticPartSegmentation or an array of\n * PartSegmentation object.\n *\n * @param
bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An\n * array of body part ids to blur. Each must be
one of the 24 body part ids.\n *\n * @param backgroundBlurAmount How many pixels in the background blend into
each\n * other. Defaults to 3. Should be an integer between 1 and 20.\n *\n * @param edgeBlurAmount How many
pixels to blur on the edge between the person\n * and the background by. Defaults to 3. Should be an integer
between 0 and 20.\n *\n * @param flipHorizontal If the output should be flipped horizontally. Defaults\n * to
false.\n */\nexport function blurBodyPart(\n  canvas: Canvas, image: ImageType,\n  partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n  bodyPartIdsToBlur = [0, 1], backgroundBlurAmount = 3,
edgeBlurAmount = 3,\n  flipHorizontal = false) {\n  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(\n    image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n
canvas.width = blurredImage.width;\n canvas.height = blurredImage.height;\n\n const ctx =
canvas.getContext('2d');\n\n if (Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n
ctx.drawImage(blurredImage, 0, 0);\n  return;\n }\n\n const bodyPartMask =\n  createBodyPartMask(partSegmentation, bodyPartIdsToBlur, edgeBlurAmount);\n\n ctx.save();\n if (flipHorizontal)
{\n  flipCanvasHorizontal(canvas);\n }\n // draw the original image on the final canvas\n const [height, width] =
getInputSize(image);\n ctx.drawImage(image, 0, 0, width, height);\n\n // \"destination-in\" - \"The existing canvas
content is kept where both the\n // new shape and existing canvas content overlap. Everything else is made\n //
transparent.\"\n // crop what's not the person using the mask from the original image\n drawWithCompositing(ctx,
bodyPartMask, 'destination-in');\n // \"destination-over\" - \"The existing canvas content is kept where both the\n //
new shape and existing canvas content overlap. Everything else is made\n // transparent.\"\n // draw the blurred
background on top of the original image where it doesn't\n // overlap.\n drawWithCompositing(ctx, blurredImage,
'destination-over');\n ctx.restore();\n}\n\n\",/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n
*\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n * limitations under the License.\n *\n *

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=====\n*\n\nexport const PART_CHANNELS: string[] = [\n 'left_face',\n 'right_face',\n 'left_upper_arm_front',\n 'left_upper_arm_back',\n 'right_upper_arm_front',\n 'right_upper_arm_back',\n 'left_lower_arm_front',\n 'left_lower_arm_back',\n 'right_lower_arm_front',\n 'right_lower_arm_back',\n 'left_hand',\n 'right_hand',\n 'torso_front',\n 'torso_back',\n 'left_upper_leg_front',\n 'left_upper_leg_back',\n 'right_upper_leg_front',\n 'right_upper_leg_back',\n 'left_lower_leg_front',\n 'left_lower_leg_back',\n 'right_lower_leg_front',\n 'right_lower_leg_back',\n 'left_feet',\n 'right_feet'\n];\n\n/** @license See the LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\n\nconst version = '2.2.0';\n\nexport {\n  version;\n},\n  names: [\n    'toFlattenedOneHotPartMap',\n    'partHeatmapScores',\n    'numParts',\n    'shape',\n    'partMapLocations',\n    'tf.argmax',\n    'partMapFlattened',\n    'tf.reshape',\n    'tf.oneHot',\n    'clipByMask2d',\n    'image',\n    'mask',\n    'tf.mul',\n    'toMaskTensor',\n    'segmentScores',\n    'threshold',\n    'tf.tidy',\n    'tf.cast',\n    'tf.greater',\n    'tf.scalar',\n    'decodePartSegmentation',\n    'segmentationMask',\n    '_a',\n    'partMapHeight',\n    'partMapWidth',\n    'flattenedMap',\n    'partNumbers',\n    'tf.expandDims',\n    'tf.range',\n    'tf.matmul',\n    'partMap',\n    'partMapShiftedUpForClipping',\n    'tf.add',\n    'tf.sub',\n    'decodeOnlyPartSegmentation',\n    'model',\n    'outputStride',\n    'this',\n    'inputShape',\n    'inputs',\n    'tf.util',\n    'assert',\n    'BaseModel',\n    'input',\n    'asFloat',\n    '_this',\n    'preprocessInput',\n    'asBatch',\n    'results3d',\n    'predict',\n    'map',\n    'y',\n    'tf.squeeze',\n    'namedResults',\n    'nameOutputResults',\n    'heatmapScores',\n    'tf.sigmoid',\n    'heatmap',\n    'offsets',\n    'displacementFwd',\n    'displacementBwd',\n    'segmentation',\n    'partHeatmaps',\n    'longOffsets',\n  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"scaleAndCropToInputTensorShape", "tensor", "applySigmoidActivation", "inputTensorHeight", "inputTensorWidth", "resizedAndPaddedHeight", "resizedAndPaddedWidth", "_e", "inResizedAndPadded", "removePaddingAndResizeBack", "originalHeight", "originalWidth", "batchedImage", "cropAndResize", "padAndResizeTo", "targetAspect", "top", "left", "right", "bottom", "toTensorBuffers3D", "tensors", "buffer", "scalePose", "offsetY", "offsetX", "scalePoses", "flipPoseHorizontal", "imageWidth", "flipPosesHorizontal", "scaleAndFlipPoses", "inputResolutionHeight", "inputResolutionWidth", "scaledPoses", "APPLY_SIGMOID_ACTIVATION", "FLIP_POSES_AFTER_SCALING", "MOBILENET_V1_CONFIG", "architecture", "VALID_ARCHITECTURE", "VALID_STRIDE", "MobileNetV1", "ResNet50", "VALID_MULTIPLIER", "VALID_QUANT_BYTES", "validateModelConfig", "config", "indexOf", "PERSON_INFERENCE_CONFIG", "segmentationThreshold", "maxDetections", "MULTI_PERSON_INSTANCE_INFERENCE_CONFIG", "validatePersonInferenceConfig", "validateMultiPersonInstanceInferenceConfig", "net", "baseModel", "BodyPix", "segmentLogits", "partHeatmapLogits", "internalResolutionHeightAndWidth", "predictForPersonSegmentation", "resizedHeight", "resizedWidth", "scaledSegmentScores", "segmentPersonActivation", "tensorBuffers", "scoresBuf", "offsetsBuf", "displacementsFwdBuf", "displacementsBwdBuf", "allPoses", "scaledLongOffsets", "predictForMultiPersonInstanceSegmentationAndPart", "heatmapScoresRaw", "offsetsRaw", "displacementFwdRaw", "displacementBwdRaw", "instanceMasks", "predictForPersonSegmentationAndPart", "scaledPartHeatmapScore", "segmentPersonPartsActivation", "scaledPartSegmentationScores", "loadMobileNet", "tf", "url", "tfconv.loadGraphModel", "modelUrl", "graphModel", "mobilenet", "loadResNet", "resnet", "load", "cpuBlur", "canvas", "blur", "ctx", "getContext", "sum", "alphaLeft", "PI", "step", "exp", "globalAlpha", "drawImage", "offScreenCanvases", "isSafari", "test", "navigator", "userAgent", "assertSameDimensions", 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T,SAAGBG,gBACZC,EAAYC,EAAYC,EAAYC,GACtC,IAAMC,EAAKF,EAAC,EAAC,EAAC,EAAC,EAAC,EA
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D,EAGT,SAASQ,yBACLF,EAAGBrG,EACb8D,EAAoC0C,OADnBpC,OAAMqC,OACtBC,OAAQC,OACL9E,
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CapC,MAC/B0F,EAAKD,EAAOzF,EAALoF,EAAoBK,EAAO/C,EAGjD1C,GAFa0D,EAAG9C,EAAYQ,eAAiB,
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AII,EA AUD,EA AUwI,GA IzCjH,EA AQ4H,GAKRZ,4BACIC,EA AYjH,EA AOtB,EA AUD,EA AUyI,EACvCC,IA
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Found in path(s):

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

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```

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=====\n*\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and\n * generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n * @param\n * partHeatmapScores\n * @function toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n * const numParts = partHeatmapScores.shape[2];\n * const partMapLocations = tf.argmax(partHeatmapScores, 2);\n * const partMapFlattened = tf.reshape(partMapLocations, [-1]);\n * return tf.oneHot(partMapFlattened, numParts) as\n * tf.Tensor2D;\n * }\n * @function clipByMask2d(image: tf.Tensor2D, mask: tf.Tensor2D): tf.Tensor2D {\n * return\n * tf.mul(image, mask);\n * }\n * Takes the sigmoid of the segmentation output, and generates a segmentation\n * mask with a 1 or 0 at each pixel where there is a person or not a person. The\n * segmentation threshold determines\n * the threshold of a score for a pixel for it\n * to be considered part of a person.\n * @param segmentScores A 3d-\n * tensor of the sigmoid of the segmentation output.\n * @param segmentationThreshold The minimum that\n * segmentation values must have\n * to be considered part of the person. Affects the generation of the\n * segmentation mask and the clipping of the colored part image.\n * @returns A segmentation mask with a 1 or 0\n * at each pixel where there is a\n * person or not a person.\n * @export function toMaskTensor(\n * segmentScores:\n * tf.Tensor2D, threshold: number): tf.Tensor2D {\n * return tf.tidy(\n * () =>\n * (tf.cast(tf.greater(\n * segmentScores, tf.scalar(threshold)), 'int32') as tf.Tensor2D));\n * }\n * Takes the sigmoid of the person and\n * part map output, and returns a 2d tensor\n * of an image with the corresponding value at each pixel corresponding to\n * the\n * part with the highest value. These part ids are clipped by the segmentation\n * mask. Wherever the a pixel is\n * clipped by the segmentation mask, its value\n * will set to -1, indicating that there is no part in that pixel.\n * @param segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n * @param partHeatmapScores A\n * 3d-tensor of the sigmoid of the part heatmap\n * output. The third dimension corresponds to the part.\n * @returns A 2d tensor of an image with the corresponding value at each pixel\n * corresponding to the part with the\n * highest value. These part ids are clipped\n * by the segmentation mask. It will have values of -1 for pixels that are\n */
```

```

* outside of the body and do not have a corresponding part.\n *^\nexport function decodePartSegmentation(\n
segmentationMask: tf.Tensor2D,\n partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n const [partMapHeight,\n
partMapWidth, numParts] = partHeatmapScores.shape;\n return tf.tidy(() => {\n const flattenedMap =\n
toFlattenedOneHotPartMap(partHeatmapScores);\n const partNumbers = tf.expandDims(tf.range(0, numParts, 1,\n
'int32'), 1);\n\n const partMapFlattened =\n tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),\n
'int32');\n\n const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n\n const\n
partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));\n\n return tf.sub(clipByMask2d(\n
partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask)\n , tf.scalar(1, 'int32')));\n });\n}\n\nexport\n
function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):\n tf.Tensor2D {\n const\n
[partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;\n return tf.tidy(() => {\n const\n
flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n const partNumbers =\n
tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);\n\n const partMapFlattened =\n
tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');\n\n return tf.reshape(partMapFlattened,\n
[partMapHeight, partMapWidth]);\n });\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights\n
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *\n
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *

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=====\n
*^\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport\n
{BodyPixOutputStride} from './types';\n\n/**\n * BodyPix supports using various convolution neural network\n
models\n * (e.g. ResNet and MobileNetV1) as its underlying base model.\n * The following BaseModel interface\n
defines a unified interface for\n * creating such BodyPix base models. Currently both MobileNet (in\n *\n
./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel\n * interface. New base models that conform\n
to the BaseModel interface can be\n * added to BodyPix.\n *^\nexport abstract class BaseModel {\n constructor(\n
protected readonly model: tfconv.GraphModel,\n public readonly outputStride: BodyPixOutputStride) {\n\n
const inputShape =\n this.model.inputs[0].shape as [number, number, number, number];\n tf.util.assert(\n
(inputShape[1] === -1) && (inputShape[2] === -1),\n () => `Input shape [${inputShape[1]}, ${inputShape[2]})\n
` +\n ` must both be equal to or -1`);\n }\n\n abstract preprocessInput(input: tf.Tensor3D): tf.Tensor3D;\n\n
/**\n * Predicts intermediate Tensor representations.\n * \n * @param input The input RGB image of the base\n
model.\n * A Tensor of shape: [inputResolution, inputResolution, 3].\n * \n * @return A dictionary of base\n
model's intermediate predictions.\n * The returned dictionary should contains the following elements:\n * -\n
heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n * - offsets: A Tensor3D that represents\n
the offsets.\n * - displacementFwd: A Tensor3D that represents the forward displacement.\n * -\n
displacementBwd: A Tensor3D that represents the backward displacement.\n * - segmentation: A Tensor3D that\n
represents the segmentation of all\n * people.\n * - longOffsets: A Tensor3D that represents the long offsets used\n
for\n * instance grouping.\n * - partHeatmaps: A Tensor3D that represents the body part segmentation.\n *^\n
predict(input: tf.Tensor3D): {\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd:\n
tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n segmentation: tf.Tensor3D,\n partHeatmaps: tf.Tensor3D,\n\n
longOffsets: tf.Tensor3D,\n partOffsets: tf.Tensor3D\n }\n\n return tf.tidy(() => {\n const asFloat =\n
this.preprocessInput(tf.cast(input, 'float32'));\n const asBatch = tf.expandDims(asFloat, 0);\n const results =\n
this.model.predict(asBatch) as tf.Tensor4D[];\n const results3d: tf.Tensor3D[] = results.map(y => tf.squeeze(y,\n
[0]));\n const namedResults = this.nameOutputResults(results3d);\n\n return {\n heatmapScores:\n
tf.sigmoid(namedResults.heatmap),\n offsets: namedResults.offsets,\n displacementFwd:\n
namedResults.displacementFwd,\n displacementBwd: namedResults.displacementBwd,\n segmentation:\n
namedResults.segmentation,\n partHeatmaps: namedResults.partHeatmaps,\n longOffsets:

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namedResults.longOffsets,\n      partOffsets: namedResults.partOffsets\n    });\n  }\n\n // Because
MobileNet and ResNet predict() methods output a different order for\n // these values, we have a method that needs
to be implemented to order them.\n  abstract nameOutputResults(results: tf.Tensor3D[]): {\n    heatmap:
tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets:
tf.Tensor3D\n  };\n\n /**\n   * Releases the CPU and GPU memory allocated by the model.\n   */\n  dispose() {\n    this.model.dispose();\n  }\n}\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport * as tf from 'tensorflow/tfjs-core';\n\nimport { BaseModel } from './base_model';\n\nexport class
MobileNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    // Normalize the pixels
[0, 255] to be between [-1, 1].\n    return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n  }\n\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets,\n    ] = results;\n    return [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    ];\n  }\n}\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple =
Tuple<number>;\n\nexport const PART_NAMES = [\n  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',
'leftShoulder',\n  'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n  'leftHip', 'rightHip', 'leftKnee',
'rightKnee',\n  'leftAnkle', 'rightAnkle'\n];\n\nexport const NUM_KEYPOINTS = PART_NAMES.length;\n\nexport
interface NumberDict {\n  [jointName: string]: number;\n}\n\nexport const PART_IDS =\nPART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n  result[jointName] = i;\n  return result;\n}, {});\n\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n  ['leftHip', 'leftShoulder'],
['leftElbow', 'leftShoulder'],\n  ['leftElbow', 'leftWrist'], ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'], ['rightHip',
'rightShoulder'],\n  ['rightElbow', 'rightShoulder'], ['rightElbow', 'rightWrist'],\n  ['rightHip', 'rightKnee'],
['rightKnee', 'rightAnkle'],\n  ['leftShoulder', 'rightShoulder'], ['leftHip', 'rightHip']\n];\n\n/*\n * Define the skeleton.
This defines the parent->child relationships of our\n * tree. Arbitrarily this defines the nose as the root of the tree,
however\n * since we will infer the displacement for both parent->child and\n * child->parent, we can define the
tree root as any node.\n */\n\nexport const POSE_CHAIN: StringTuple[] = [\n  ['nose', 'leftEye'], ['leftEye', 'leftEar'],
['nose', 'rightEye'],\n  ['rightEye', 'rightEar'], ['nose', 'leftShoulder'],\n  ['leftShoulder', 'leftElbow'], ['leftElbow',
'leftWrist'],\n  ['leftShoulder', 'leftHip'], ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'], ['nose', 'rightShoulder'],\n
['rightShoulder', 'rightElbow'], ['rightElbow', 'rightWrist'],\n  ['rightShoulder', 'rightHip'], ['rightHip', 'rightKnee'],\n
['rightKnee', 'rightAnkle']\n];\n\nexport const CONNECTED_PART_INDICES =
CONNECTED_PART_NAMES.map(\n  ([jointNameA, jointNameB]) =>\n    ([PART_IDS[jointNameA],\n    PART_IDS[jointNameB]]);\n), "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from
 './types';\n\nexport function getScale(\n  [height, width]: [number, number],\n  [inputResolutionY,
inputResolutionX]: [number, number],\n  padding: Padding): [number, number] {\n  const {top: padT, bottom:
padB, left: padL, right: padR} = padding;\n  const scaleY = inputResolutionY / (padT + padB + height);\n  const
scaleX = inputResolutionX / (padL + padR + width);\n  return [scaleX, scaleY];\n}\n\nexport function
getOffsetPoint(\n  y: number, x: number, keypoint: number, offsets: TensorBuffer3D): Vector2D {\n  return {\n
y: offsets.get(y, x, keypoint),\n  x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)\n };\n}\n\nexport function
getImageCoords(\n  part: Part, outputStride: number, offsets: TensorBuffer3D): Vector2D {\n  const {heatmapY,
heatmapX, id: keypoint} = part;\n  const {y, x} = getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n  return
{\n  x: part.heatmapX * outputStride + x,\n  y: part.heatmapY * outputStride + y\n };\n}\n\nexport function
fillArray<T>(element: T, size: number): T[] {\n  const result: T[] = new Array(size);\n  for (let i = 0; i < size; i++)
{\n  result[i] = element;\n }\n  return result;\n}\n\nexport function clamp(a: number, min: number, max:
number): number {\n  if (a < min) {\n  return min;\n }\n  if (a > max) {\n  return max;\n }\n  return
a;\n}\n\nexport function squaredDistance(\n  y1: number, x1: number, y2: number, x2: number): number {\n  const
dy = y2 - y1;\n  const dx = x2 - x1;\n  return dy * dy + dx * dx;\n}\n\nexport function addVectors(a: Vector2D, b:
Vector2D): Vector2D {\n  return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a: Vector2D, min:
number, max: number): Vector2D {\n  return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};\n}\n\n\"/**\n *
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(the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {NUM_KEYPOINTS} from './keypoints';\nimport {Padding, Pose} from './types';\n\nimport
{getScale} from './util';\n\ninterface Pair {\n  x: number;\n  y: number;\n}\n\nfunction computeDistance(embedding:
Pair[], pose: Pose, minPartScore = 0.3) {\n  let distance = 0.0;\n  let numKpt = 0;\n  for (let p = 0; p <
embedding.length; p++) {\n  if (pose.keypoints[p].score > minPartScore) {\n  numKpt += 1;\n  distance +=
(embedding[p].x - pose.keypoints[p].position.x) ** 2 +\n    (embedding[p].y - pose.keypoints[p].position.y) **
2;\n  }\n  }\n  if (numKpt === 0) {\n  distance = Infinity;\n  } else {\n  distance = distance / numKpt;\n  }\n  return distance;\n}\n\nfunction convertToPositionInOutput(\n  position: Pair, [padT, padL]: [number, number],\n  [scaleX, scaleY]: [number, number], stride: number): Pair {\n  const y = Math.round(((padT + position.y + 1.0) *
scaleY - 1.0) / stride);\n  const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);\n  return {x,
y};\n}\n\nfunction getEmbedding(\n  location: Pair, keypointIndex: number,\n  convertToPosition: (pair: Pair) =>
Pair, outputResolutionX: number,\n  longOffsets: Float32Array, refineSteps: number,\n  [height, width]: [number,
number]): Pair {\n  const newLocation = convertToPosition(location);\n  const nn = newLocation.y *
outputResolutionX + newLocation.x;\n  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n  let
dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];\n  let y = location.y + dy;\n  let x =
location.x + dx;\n  for (let t = 0; t < refineSteps; t++) {\n  y = Math.min(y, height - 1);\n  x = Math.min(x, width -
1);\n  const newPos = convertToPosition({x, y});\n  const nn = newPos.y * outputResolutionX + newPos.x;\n  dy =
longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];\n  dx = longOffsets[NUM_KEYPOINTS * (2
* nn + 1) + keypointIndex];\n  y = y + dy;\n  x = x + dx;\n  }\n  return {x, y};\n}\n\nfunction

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= longOffsets.shape.slice(0, 2);\n\n const shapedLongOffsets: tf.Tensor4D =\n  tf.reshape(longOffsets,\n [outHeight, outWidth, 2, NUM_KEYPOINTS]);\n\n // Make pose tensor of shape [MAX_NUM_PEOPLE,\n NUM_KEYPOINTS, 3] where\n // the last 3 coordinates correspond to the score, h and w coordinate of that\n // keypoint.\n const poseVals = new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n for (let i =\n 0; i < posesAboveScore.length; i++) {\n  const poseOffset = i * NUM_KEYPOINTS * 3;\n  const pose =\n  posesAboveScore[i];\n  for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n    const keypoint =\n    pose.keypoints[kp];\n    const offset = poseOffset + kp * 3;\n    poseVals[offset] = keypoint.score;\n    poseVals[offset + 1] = keypoint.position.y;\n    poseVals[offset + 2] = keypoint.position.x;\n  }\n}\n\n const\n [scaleX, scaleY] =\n  getScale([height, width], [inHeight, inWidth], padding);\n\n const posesTensor =\n  tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n\n const {top: padT, left: padL} = padding;\n\n const program: tf_webgl.GPGPUProgram = {\n  variableNames: ['segmentation', 'longOffsets', 'poses'],\n  outputShape: [origHeight, origWidth],\n  userCode: `\n  int convertToPositionInOutput(int pos, int pad, float\n  scale, int stride) {\n    return round(((float(pos + pad) + 1.0) * scale - 1.0) / float(stride));\n  }\n\n  float\n  convertToPositionInOutputFloat(\n    int pos, int pad, float scale, int stride) {\n    return ((float(pos + pad) + 1.0)\n * scale - 1.0) / float(stride);\n  }\n\n  float dist(float x1, float y1, float x2, float y2) {\n    return pow(x1 - x2, 2.0)\n + pow(y1 - y2, 2.0);\n  }\n\n  float sampleLongOffsets(float h, float w, int d, int k) {\n    float fh = fract(h);\n    float fw = fract(w);\n    int cIH = int(ceil(h));\n    int cIW = int(ceil(w));\n    int fIH = int(floor(h));\n    int fIW =\n    int(floor(w));\n    float o11 = getLongOffsets(fIH, fIW, d, k);\n    float o12 = getLongOffsets(fIH, cIW, d, k);\n    float o21 = getLongOffsets(cIH, fIW, d, k);\n    float o22 = getLongOffsets(cIH, cIW, d, k);\n    float o1 =\n    mix(o11, o12, fw);\n    float o2 = mix(o21, o22, fw);\n    return mix(o1, o2, fh);\n  }\n\n  int\n  findNearestPose(int h, int w) {\n    float prob = getSegmentation(h, w);\n    if (prob < 1.0) {\n    return -1;\n  }\n\n  // Done(Tyler): convert from output space h/w to strided space.\n  float stridedH =\n  convertToPositionInOutputFloat(\n    h, ${padT}, ${scaleY}, ${stride});\n  float stridedW =\n  convertToPositionInOutputFloat(\n    w, ${padL}, ${scaleX}, ${stride});\n\n  float minDist = 1000000.0;\n  int iMin = -1;\n  for (int i = 0; i < ${maxNumPeople}; i++) {\n    float curDistSum = 0.0;\n    int numKpt =\n    0;\n    for (int k = 0; k < ${NUM_KEYPOINTS}; k++) {\n      float dy = sampleLongOffsets(stridedH,\n stridedW, 0, k);\n      float dx = sampleLongOffsets(stridedH, stridedW, 1, k);\n\n      float y = float(h) + dy;\n      float x = float(w) + dx;\n\n      for (int s = 0; s < ${refineSteps}; s++) {\n        int yRounded = round(min(y,\n float(${height - 1.0}));\n        int xRounded = round(min(x, float(${width - 1.0}));\n\n        float yStrided =\n        convertToPositionInOutputFloat(\n          yRounded, ${padT}, ${scaleY}, ${stride});\n        float xStrided =\n        convertToPositionInOutputFloat(\n          xRounded, ${padL}, ${scaleX}, ${stride});\n\n        float dy =\n        sampleLongOffsets(yStrided, xStrided, 0, k);\n        float dx = sampleLongOffsets(yStrided, xStrided, 1, k);\n\n        y = y + dy;\n        x = x + dx;\n      }\n\n      float poseScore = getPoses(i, k, 0);\n      float poseY =\n      getPoses(i, k, 1);\n      float poseX = getPoses(i, k, 2);\n      if (poseScore > ${minKptScore}) {\n        numKpt = numKpt + 1;\n        curDistSum = curDistSum + dist(x, y, poseX, poseY);\n      }\n    }\n    if\n    (numKpt > 0 && curDistSum / float(numKpt) < minDist) {\n      minDist = curDistSum / float(numKpt);\n      iMin = i;\n    }\n  }\n  return iMin;\n}\n\n void main() {\n  ivec2 coords = getOutputCoords();\n  int nearestPose = findNearestPose(coords[0], coords[1]);\n  setOutput(float(nearestPose));\n}\n\n`;\n\n const webglBackend = tf.backend() as tf_webgl.MathBackendWebGL;\n return webglBackend.compileAndRun(\n  program, [segmentation, shapedLongOffsets, posesTensor]);\n\n"/*\n * @license\n * Copyright 2019 Google\n Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

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*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {getBackend} from '@tensorflow/tfjs-core';\nimport

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{Padding, PartSegmentation, PersonSegmentation, Pose} from './types';\n\nimport {decodeMultipleMasksCPU,
decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';\nimport {decodeMultipleMasksWebGl} from
 './decode_multiple_masks_webgl';\n\nexport function toPersonKSegmentation(\n  segmentation: tf.Tensor2D, k:
number): tf.Tensor2D {\n  return tf.tidy(\n    () => (tf.cast(tf.equal(\n      segmentation, tf.scalar(k)), 'int32') as
tf.Tensor2D));\n  }\n}\n\nexport function toPersonKPartSegmentation(\n  segmentation: tf.Tensor2D, bodyParts:
tf.Tensor2D, k: number): tf.Tensor2D {\n  return tf.tidy(\n    () => tf.sub(tf.mul(tf.cast(tf.equal(\n
segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));\n  }\n}\n\nfunction isWebGLBackend() {\n  return
getBackend() === 'webgl';\n}\n\nexport async function decodePersonInstanceMasks(\n  segmentation:
tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[],\n  height: number, width: number, stride: number,\n  [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2,\n  refineSteps = 8, minKeypointScore = 0.3,\n  maxNumPeople = 10): Promise<PersonSegmentation[]> {\n  // Filter out poses with
smaller score.\n  const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);\n\n  let
personSegmentationsData: Uint8Array[];\n\n  if (isWebGLBackend()) {\n    const personSegmentations = tf.tidy(()
=> {\n      const masksTensorInfo = decodeMultipleMasksWebGl(\n        segmentation, longOffsets,
posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding, refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor = tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId,
masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n
        (_, k) => toPersonKSegmentation(masksTensor, k));\n    });\n\n    personSegmentationsData =\n      (await
Promise.all(personSegmentations.map(mask => mask.data())) as\n        Uint8Array[]);\n\n    personSegmentations.forEach(x => x.dispose());\n  } else {\n    const segmentationsData = await
segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n\n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData, longOffsetsData,
posesAboveScore, height, width,\n      stride, [inHeight, inWidth], padding, refineSteps);\n  }\n\n  return
personSegmentationsData.map(\n    (data, i) => ({data, pose: posesAboveScore[i], width, height});\n  );\n}\n\nexport
async function decodePersonInstancePartMasks(\n  segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n  partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n  stride: number, [inHeight,
inWidth]: [number, number], padding: Padding,\n  minPoseScore = 0.2, refineSteps = 8, minKeypointScore =
0.3,\n  maxNumPeople = 10): Promise<PartSegmentation[]> {\n  const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n\n  let partSegmentationsByPersonData: Int32Array[];\n\n  if (isWebGLBackend())
{\n    const partSegmentations = tf.tidy(() => {\n      const masksTensorInfo = decodeMultipleMasksWebGl(\n
segmentation, longOffsets, posesAboveScore, height, width, stride,\n        [inHeight, inWidth], padding,
refineSteps, minKeypointScore,\n        maxNumPeople);\n      const masksTensor =
tf.engine().makeTensorFromDataId(\n        masksTensorInfo.dataId, masksTensorInfo.shape,\n        masksTensorInfo.dtype) as tf.Tensor2D;\n      return posesAboveScore.map(\n
        (_, k) => \n      toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n    });\n\n    partSegmentationsByPersonData =\n      (await Promise.all(partSegmentations.map(x => x.data())) as\n        Int32Array[]);\n\n    partSegmentations.forEach(x => x.dispose());\n  } else {\n    const segmentationsData = await segmentation.data()
as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n    const
partSegmentaionData = await partSegmentation.data() as Uint8Array;\n\n    partSegmentationsByPersonData =
decodeMultiplePartMasksCPU(\n      segmentationsData, longOffsetsData, partSegmentaionData,\n      posesAboveScore, height, width, stride, [inHeight, inWidth], padding,\n      refineSteps);\n  }\n\n  return
partSegmentationsByPersonData.map(\n    (data, k) => ({pose: posesAboveScore[k], data, height,
width});\n  );\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the

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License.\n *

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=====\n
*\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n\n//
https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n return
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n private priorityQueue: T[];\n private numberOfElements:
number;\n private getElementValue: (element: T) => number;\n\n constructor(maxSize: number, getElementValue:
(element: T) => number) {\n this.priorityQueue = new Array(maxSize);\n this.numberOfElements = -1;\n
this.getElementValue = getElementValue;\n }\n\n public enqueue(x: T): void {\n
this.priorityQueue[++this.numberOfElements] = x;\n this.swim(this.numberOfElements);\n }\n\n public
dequeue(): T {\n const max = this.priorityQueue[0];\n this.exchange(0, this.numberOfElements--);\n
this.sink(0);\n this.priorityQueue[this.numberOfElements + 1] = null;\n return max;\n }\n\n public empty():
boolean {\n return this.numberOfElements === -1;\n }\n\n public size(): number {\n return
this.numberOfElements + 1;\n }\n\n public all(): T[] {\n return this.priorityQueue.slice(0, this.numberOfElements
+ 1);\n }\n\n public max(): T {\n return this.priorityQueue[0];\n }\n\n private swim(k: number): void {\n while
(k > 0 && this.less(half(k), k)) {\n this.exchange(k, half(k));\n k = half(k);\n }\n }\n\n private sink(k:
number): void {\n while (2 * k <= this.numberOfElements) {\n let j = 2 * k;\n if (j < this.numberOfElements
&& this.less(j, j + 1)) {\n j++;\n }\n if (!this.less(k, j)) {\n break;\n }\n this.exchange(k, j);\n
k = j;\n }\n }\n\n private getValueAt(i: number): number {\n return
this.getElementValue(this.priorityQueue[i]);\n }\n\n private less(i: number, j: number): boolean {\n return
this.getValueAt(i) < this.getValueAt(j);\n }\n\n private exchange(i: number, j: number): void {\n const t =
this.priorityQueue[i];\n this.priorityQueue[i] = this.priorityQueue[j];\n this.priorityQueue[j] = t;\n }\n\n\n",/**\n
* @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {PartWithScore, TensorBuffer3D} from './types';\n\nimport {MaxHeap} from
'./max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n const
[height, width] = scores.shape;\n\n let localMaximum = true;\n const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n for (let
yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n localMaximum
= false;\n break;\n }\n }\n if (!localMaximum) {\n break;\n }\n }\n\n return
localMaximum;\n }\n\n\n/**\n * Builds a priority queue with part candidate positions for a specific image in\n * the
batch. For this we find all local maxima in the score maps with score\n * values above a threshold. We create a
single priority queue across all parts.\n */\n\nexport function buildPartWithScoreQueue(\n scoreThreshold: number,
localMaximumRadius: number,\n scores: TensorBuffer3D): MaxHeap<PartWithScore> {\n const [height, width,
numKeypoints] = scores.shape;\n\n const queue = new MaxHeap<PartWithScore>(\n height * width *
numKeypoints, ({score}) => score);\n\n for (let heatmapY = 0; heatmapY < height; ++heatmapY) {\n for (let
heatmapX = 0; heatmapX < width; ++heatmapX) {\n for (let keypointId = 0; keypointId < numKeypoints;
++keypointId) {\n const score = scores.get(heatmapY, heatmapX, keypointId);\n\n // Only consider parts
with score greater or equal to threshold as\n // root candidates.\n if (score < scoreThreshold) {\n
continue;\n }\n\n // Only consider keypoints whose score is maximum in a local window.\n if
(scoreIsMaximumInLocalWindow(\n keypointId, score, heatmapY, heatmapX, localMaximumRadius,\n
```



```

    scores)) {\n      queue.enqueue({score, part: {heatmapY, heatmapX, id: keypointId}});\n    }\n  }\n  }\n  return queue;\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\nimport {Keypoint,\nPartWithScore, TensorBuffer3D, Vector2D} from './types';\nimport {clamp, getOffsetPoint} from './util';\nimport {\naddVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =\nPOSE_CHAIN.map([\n  ([parentJoinName, childJoinName]): NumberTuple =>\n  ([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n]);\n\nconst parentToChildEdges: number[] =\nparentChildrenTuples.map([\n  childJointId] => childJointId);\n\nconst childToParentEdges: number[] =\nparentChildrenTuples.map([\n  parentJointId,\n  childJointId] =>\n  parentJointId);\n\nfunction getDisplacement(\n  edgeId: number, point: Vector2D, displacements:\n  TensorBuffer3D): Vector2D {\n  const numEdges = displacements.shape[2] / 2;\n  return {\n    y:\n  displacements.get(point.y, point.x, edgeId),\n    x: displacements.get(point.y, point.x, numEdges + edgeId)\n  };\n}\n\nfunction getStridedIndexNearPoint(\n  point: Vector2D, outputStride: number, height: number,\n  width:\n  number): Vector2D {\n  return {\n    y: clamp(Math.round(point.y / outputStride), 0, height - 1),\n    x:\n  clamp(Math.round(point.x / outputStride), 0, width - 1)\n  };\n}\n\n/**\n * We get a new keypoint along the\n * `edgeId` for the pose instance, assuming\n * that the position of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target part (stored in\n * the `i`-t channel of the displacement\n * tensor). The displaced keypoint\n * vector is refined using the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n  edgeId: number, sourceKeypoint: Keypoint, targetKeypointId:\n  number,\n  scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D, outputStride: number,\n  displacements:\n  TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n  const [height, width] = scoresBuffer.shape;\n  // Nearest\n  neighbor interpolation for the source->target displacements.\n  const sourceKeypointIndices =\n  getStridedIndexNearPoint(\n    sourceKeypoint.position, outputStride, height, width);\n  const displacement =\n  getDisplacement(edgeId, sourceKeypointIndices, displacements);\n  const displacedPoint =\n  addVectors(sourceKeypoint.position, displacement);\n  let targetKeypoint = displacedPoint;\n  for (let i = 0; i <\n  offsetRefineStep; i++) {\n    const targetKeypointIndices =\n    getStridedIndexNearPoint(targetKeypoint,\n    outputStride, height, width);\n    const offsetPoint = getOffsetPoint(\n    targetKeypointIndices.y,\n    targetKeypointIndices.x, targetKeypointId,\n    offsets);\n    targetKeypoint = addVectors(\n    {\n      x:\n    targetKeypointIndices.x * outputStride,\n      y: targetKeypointIndices.y * outputStride\n    },\n    {\n      x:\n    offsetPoint.x, y: offsetPoint.y\n    });\n  }\n  const targetKeypointIndices =\n  getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n  const score = scoresBuffer.get(\n  targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);\n  return {position: targetKeypoint, part:\n  PART_NAMES[targetKeypointId], score};\n}\n\n/**\n * Follows the displacement fields to decode the full pose of\n * the object\n * instance given the position of a part that acts as root.\n */\n * @return An array of decoded keypoints\n * and their scores for a single pose\n */\nexport function decodePose(\n  root: PartWithScore, scores:\n  TensorBuffer3D, offsets: TensorBuffer3D,\n  outputStride: number, displacementsFwd: TensorBuffer3D,\n  displacementsBwd: TensorBuffer3D): Keypoint[] {\n  const numParts = scores.shape[2];\n  const numEdges =\n  parentToChildEdges.length;\n  const instanceKeypoints: Keypoint[] = new Array(numParts);\n  // Start a new\n  detection instance at the position of the root.\n  const {part: rootPart, score: rootScore} = root;\n  const rootPoint =\n  getImageCoords(rootPart, outputStride, offsets);\n  instanceKeypoints[rootPart.id] = {\n    score: rootScore,\n    part: PART_NAMES[rootPart.id],\n    position: rootPoint\n  };\n  // Decode the part positions upwards in the tree,\n
```

```

following the backward\n // displacements.\n for (let edge = numEdges - 1; edge >= 0; --edge) {\n  const
sourceKeypointId = parentToChildEdges[edge];\n  const targetKeypointId = childToParentEdges[edge];\n  if
(instanceKeypoints[sourceKeypointId] &&\n    !instanceKeypoints[targetKeypointId]) {\n
instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n    edge,
instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n    offsets, outputStride, displacementsBwd);\n
  }\n }\n\n // Decode the part positions downwards in the tree, following the forward\n // displacements.\n for (let
edge = 0; edge < numEdges; ++edge) {\n  const sourceKeypointId = childToParentEdges[edge];\n  const
targetKeypointId = parentToChildEdges[edge];\n  if (instanceKeypoints[sourceKeypointId] &&\n
!instanceKeypoints[targetKeypointId]) {\n    instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n
edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n    offsets, outputStride,
displacementsFwd);\n  }\n }\n\n return instanceKeypoints;\n}\n", "/*\n * @license\n * Copyright 2019 Google
Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport { Keypoint, Pose, TensorBuffer3D } from './types';\n\nimport { buildPartWithScoreQueue } from
 './build_part_with_score_queue';\n\nimport { decodePose } from './decode_pose';\n\nimport { getImageCoords,
squaredDistance } from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n  poses: Pose[],
squaredNmsRadius: number, {x, y}: {x: number, y: number},\n  keypointId: number): boolean {\n  return
poses.some((({keypoints}) => {\n    const correspondingKeypoint = keypoints[keypointId].position;\n    return
squaredDistance(\n      y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n
squaredNmsRadius;\n  }));\n}\n\n/* Score the newly proposed object instance without taking into account\n * the
scores of the parts that overlap with any previously detected\n * instance.\n */\nfunction getInstanceScore(\n
existingPoses: Pose[], squaredNmsRadius: number,\n  instanceKeypoints: Keypoint[]): number {\n  let
notOverlappedKeypointScores = instanceKeypoints.reduce(\n    (result, {position, score}, keypointId): number =>
{\n    if (!withinNmsRadiusOfCorrespondingPoint(\n      existingPoses, squaredNmsRadius, position,
keypointId)) {\n      result += score;\n    }\n    return result;\n  }, 0.0);\n\n  return
notOverlappedKeypointScores /= instanceKeypoints.length;\n}\n\n// A point (y, x) is considered as root part
candidate if its score is a\n// maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n//
kLocalMaximumRadius.\nconst kLocalMaximumRadius = 1;\n\n/**\n * Detects multiple poses and finds their parts
from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in
decreasing root score order. It works as follows: We first\n * create a priority queue with local part score maxima
above\n * `scoreThreshold`, considering all parts at the same time. Then we\n * iteratively pull the top element of
the queue (in decreasing score order)\n * and treat it as a root candidate for a new object instance. To avoid\n *
duplicate detections, we reject the root candidate if it is within a disk\n * of `nmsRadius` pixels from the
corresponding part of a previously detected\n * instance, which is a form of part-based non-maximum suppression
(NMS). If\n * the root candidate passes the NMS check, we start a new object instance\n * detection, treating the
corresponding part as root and finding the\n * positions of the remaining parts by following the displacement
vectors\n * along the tree-structured part graph. We assign to the newly detected\n * instance a score equal to the
sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at least `nmsRadius`\n
* pixels away from the corresponding part of all previously detected\n * instances), divided by the total number of
parts `numParts`.\n */\n * @param heatmapScores 3-D tensor with shape `[height, width, numParts]`.\n * The value
of heatmapScores[y, x, k] is the score of placing the `k`-th\n * object part at position `(y, x)`.\n * @param
offsets 3-D tensor with shape `[height, width, numParts * 2]`.\n * The value of [offsets[y, x, k], offsets[y, x, k +
numParts]] is the\n * short range offset vector of the `k`-th object part at heatmap\n * position `(y, x)`.\n *

```



```

0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n
internalResolution: BodyPixInternalResolution): number {\n if (typeof internalResolution === 'string') {\n  const
result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n\n  tf.util.assert(\n    typeof result
=== 'number',\n    () => `string value of inputResolution must be one of ${\n
Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n      .join(',')\n    } but was
${internalResolution}.`);\n  return result;\n } else {\n  tf.util.assert(\n    typeof internalResolution === 'number'
&&\n    internalResolution <= MAX_INTERNAL_RESOLUTION &&\n    internalResolution >=
MIN_INTERNAL_RESOLUTION,\n    () =>\n      `inputResolution must be a string or number between ${\n
MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION}, but ` +\n      `was
${internalResolution}`);\n\n  return internalResolution;\n }\n}\n\n\nexport function
toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n\n  return [\n
toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n    inputWidth * internalResolutionPercentage, outputStride)\n  ];\n}\n\n\nexport function
toInputTensor(input: BodyPixInput) {\n  // TODO: tf.browser.fromPixels types to support OffscreenCanvas\n  //
@ts-ignore\n  return input instanceof tf.Tensor ? input : tf.browser.fromPixels(input);\n}\n\n\nexport function
resizeAndPadTo(\n  imageTensor: tf.Tensor3D, [targetH, targetW]: [number, number],\n  flipHorizontal = false):
{\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy: [[number, number], [number, number]]\n} {\n  const [height,
width] = imageTensor.shape;\n\n  const targetAspect = targetW / targetH;\n  const aspect = width / height;\n\n  let
resizeW: number;\n  let resizeH: number;\n  let padL: number;\n  let padR: number;\n  let padT: number;\n  let
padB: number;\n\n  if (aspect > targetAspect) {\n    // resize to have the larger dimension match the shape.\n
resizeW = targetW;\n    resizeH = Math.ceil(resizeW / aspect);\n\n    const padHeight = targetH - resizeH;\n    padL
= 0;\n    padR = 0;\n    padT = Math.floor(padHeight / 2);\n    padB = targetH - (resizeH + padT);\n  } else {\n
resizeH = targetH;\n    resizeW = Math.ceil(targetH * aspect);\n\n    const padWidth = targetW - resizeW;\n    padL
= Math.floor(padWidth / 2);\n    padR = targetW - (resizeW + padL);\n    padT = 0;\n    padB = 0;\n  }\n\n  const
resizedAndPadded = tf.tidy(() => {\n    // resize to have largest dimension match image\n    let resized:
tf.Tensor3D;\n    if (flipHorizontal) {\n      resized = tf.image.resizeBilinear(\n        tf.reverse(imageTensor, 1),
[resizeH, resizeW]);\n    } else {\n      resized = tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n    }\n\n
const padded = tf.pad3d(resized, [[padT, padB], [padL, padR], [0, 0]]);\n\n    return padded;\n  });\n\n  return
{resizedAndPadded, paddedBy: [[padT, padB], [padL, padR]]};\n}\n\n\nexport function
scaleAndCropToInputTensorShape(\n  tensor: tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number,
number],\n  [resizedAndPaddedHeight, resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL,
padR]]: [[number, number], [number, number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return
tf.tidy(() => {\n    let inResizedAndPadded: tf.Tensor3D = tf.image.resizeBilinear(tensor,\n
[resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n\n    if (applySigmoidActivation) {\n      inResizedAndPadded
= tf.sigmoid(inResizedAndPadded);\n    }\n\n    return removePaddingAndResizeBack(\n
inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n      [[padT, padB], [padL, padR]]);\n  });\n}\n\n\nexport function removePaddingAndResizeBack(\n
resizedAndPadded: tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL,
padR]]: [[number, number], [number, number]]):\n  tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage:
tf.Tensor4D = tf.expandDims(resizedAndPadded);\n\n    return tf.squeeze(tf.image\n      .cropAndResize(\n
batchedImage, [[\n        padT / (originalHeight +\n        padT + padB - 1.0),\n        padL / (originalWidth + padL + padR - 1.0),\n        (padT + originalHeight - 1.0)\n      ]\n      (\n        originalHeight + padT + padB - 1.0),\n        (padL + originalWidth - 1.0) / (originalWidth + padL\n        + padR - 1.0)\n      ]),\n      [0], [originalHeight, originalWidth], [0]);\n  });\n}\n\n\nexport function resize2d(\n
tensor: tf.Tensor2D, resolution: [number, number],\n  nearestNeighbor?: boolean): tf.Tensor2D {\n  return
tf.tidy(() => {\n    const batchedImage: tf.Tensor4D = tf.expandDims(tensor, 2);\n\n    return tf.squeeze(\n
tf.image.resizeBilinear(batchedImage, resolution, nearestNeighbor));\n  });\n}\n\n\nexport function

```


intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the `segmentationThreshold`, it will be set to 1 otherwise 0.

```

export interface InferenceConfig {
  flipHorizontal?: boolean;
  internalResolution?: BodyPixInternalResolution;
  segmentationThreshold?: number;
}

export interface PersonInferenceConfig extends InferenceConfig {
  maxDetections?: number;
  scoreThreshold?: number;
  nmsRadius?: number;
}

export interface MultiplePersonInstanceInferenceConfig extends PersonInferenceConfig {
  minKeypointScore?: number;
  refineSteps?: number;
}

export const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
};

export const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiplePersonInstanceInferenceConfig = {
  flipHorizontal: false,
  internalResolution: 'medium',
  segmentationThreshold: 0.7,
  maxDetections: 10,
  scoreThreshold: 0.4,
  nmsRadius: 20,
  minKeypointScore: 0.3,
  refineSteps: 10,
};

function validatePersonInferenceConfig(config: PersonInferenceConfig) {
  const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius } = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}`);
  }
}

function validateMultiPersonInstanceInferenceConfig(config: MultiplePersonInstanceInferenceConfig) {
  const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius, minKeypointScore, refineSteps } = config;
  if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
    throw new Error(`segmentationThreshold ${segmentationThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (maxDetections <= 0) {
    throw new Error(`Invalid maxDetections ${maxDetections}. Should be > 0`);
  }
  if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
    throw new Error(`Invalid scoreThreshold ${scoreThreshold}. Should be in range [0.0, 1.0]`);
  }
  if (nmsRadius <= 0) {
    throw new Error(`Invalid nmsRadius ${nmsRadius}`);
  }
  if (minKeypointScore < 0 || minKeypointScore > 1) {
    throw new Error(`Invalid minKeypointScore ${minKeypointScore}. Should be in range [0.0, 1.0]`);
  }
  if (refineSteps <= 0 || refineSteps > 20) {
    throw new Error(`Invalid refineSteps ${refineSteps}. Should be in range [1, 20]`);
  }
}

export class BodyPix {
  baseModel: BaseModel;

  constructor(net: BaseModel) {
    this.baseModel = net;
  }

  private predictForPersonSegmentation(input: tf.Tensor3D): {
    segmentLogits: tf.Tensor3D,
    heatmapScores: tf.Tensor3D,
    offsets: tf.Tensor3D,
    displacementFwd: tf.Tensor3D,
    displacementBwd: tf.Tensor3D,
  } {
    const { segmentation, heatmapScores, offsets, displacementFwd, displacementBwd } = this.baseModel.predict(input);
    return {
      segmentLogits: segmentation,
      heatmapScores,
    };
  }
}

```



```

offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n
partHeatmapLogits: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd:
tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n } {\n const {\n segmentation,\n partHeatmaps,\n
heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = this.baseModel.predict(input);\n
return {\n segmentLogits: segmentation,\n partHeatmapLogits: partHeatmaps,\n heatmapScores,\n
offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n { \n segmentLogits:
tf.Tensor3D,\n longOffsets: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n
displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n partHeatmaps: tf.Tensor3D\n } {\n
const {\n segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n
displacementBwd,\n partHeatmaps,\n } = this.baseModel.predict(input);\n return {\n segmentLogits:
segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n
partHeatmaps\n };\n }\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n *
tensors including: 1) a binary array with 1 for the pixels that are part of\n * the person, and 0 otherwise, 2)
heatmapScores, 3) offsets, and 4) paddings.\n *\n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n *\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that
the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the
cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value
between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n
*\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered
part of the person. Affects the generation of the\n * segmentation mask.\n *\n * @return A dictionary containing
`segmentation`, `heatmapScores`, `offsets`,\n * and `padding`:\n * - `segmentation`: A 2d Tensor with 1 for the
pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to the same\n *
dimensions of the input image.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * pose
estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation decoding.\n
* - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose estimation decoding.\n
* - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation
decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the
model.\n */\n segmentPersonActivation(\n input: BodyPixInput, internalResolution:
BodyPixInternalResolution,\n segmentationThreshold = 0.5): {\n segmentation: tf.Tensor2D,\n
heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd:
tf.Tensor3D,\n padding: Padding,\n internalResolutionHeightAndWidth: [number, number]\n } {\n const
[height, width] = getInputSize(input);\n const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(\n internalResolution, this.baseModel.outputStride, [height, width]);\n
const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const {\n
segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd\n } = tf.tidy(() =>
{\n const {\n segmentLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n
displacementBwd\n } = this.predictForPersonSegmentation(resized);\n\n const [resizedHeight, resizedWidth]
= resized.shape;\n\n const scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits,
[height, width], [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left,
padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n\n return {\n segmentation: toMaskTensor(\n
tf.squeeze(scaledSegmentScores), segmentationThreshold),\n heatmapScores,\n offsets,\n
displacementFwd,\n displacementBwd,\n };\n });\n resized.dispose();\n return {\n segmentation,\n
heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n padding,\n
internalResolutionHeightAndWidth\n };\n }\n\n /**\n * Given an image with many people, returns a
PersonSegmentation dictionary\n * that contains the segmentation mask for all people and a single pose.\n *\n *

```

Note: The segmentation mask returned by this method covers all people but the pose works well for one person. If you want to estimate instance-level multiple person segmentation & pose for each person, use `segmentMultiPerson` instead.

`@param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)` The input image to feed through the network.

`@param config PersonInferenceConfig` object that contains parameters for the BodyPix inference using person decoding.

`@return` A `SemanticPersonSegmentation` dictionary that contains height, width, the flattened binary segmentation mask and the poses for all people. The width and height correspond to the same dimensions of the input image.

- `height`: The height of the segmentation data in pixel unit.
- `width`: The width of the segmentation data in pixel unit.
- `data`: The flattened `Uint8Array` of segmentation data. 1 means the pixel belongs to a person and 0 means the pixel doesn't belong to a person. The size of the array is equal to `height` x `width` in row-major order.
- `allPoses`: The 2d poses of all people.

```

^
async segmentPerson(
  input: BodyPixInput,
  config: PersonInferenceConfig =
    PERSON_INFERENCE_CONFIG):
  Promise<SemanticPersonSegmentation> {
    config =
    {...PERSON_INFERENCE_CONFIG, ...config};
    validatePersonInferenceConfig(config);
    const {
      segmentation,
      heatmapScores,
      offsets,
      displacementFwd,
      displacementBwd,
      padding,
      internalResolutionHeightAndWidth
    } =
      this.segmentPersonActivation(
        input,
        config.internalResolution,
        config.segmentationThreshold);
    const [height, width] = segmentation.shape;
    const result = await segmentation.data() as Uint8Array;
    segmentation.dispose();
    const tensorBuffers =
      await toTensorBuffers3D(
        [heatmapScores, offsets, displacementFwd, displacementBwd]);
    const
      [scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =
        tensorBuffers;
    let poses =
      decodeMultiplePoses(
        scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,
        this.baseModel.outputStride, config.maxDetections,
        config.scoreThreshold, config.nmsRadius);
    poses =
      scaleAndFlipPoses(
        poses, [height, width], internalResolutionHeightAndWidth, padding,
        FLIP_POSES_AFTER_SCALING);
    heatmapScores.dispose();
    offsets.dispose();
    displacementFwd.dispose();
    displacementBwd.dispose();
    return {height, width, data: result, allPoses:
      poses};
  }
  /**
   * Given an image with multiple people, returns an array of
   * PersonSegmentation object. Each element in the array corresponding to one
   * of the people in the input image. In other words, it
   * predicts instance-level multiple person segmentation & pose for each person.
   * The model does standard ImageNet pre-processing before inferring through
   * the model. The image pixels should have values [0-255].
   * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement
   * The input image to feed through the network.
   * @param config MultiPersonInferenceConfig object that contains
   * parameters for the BodyPix inference using multi-person decoding.
   * @return An array of PersonSegmentation object, each containing a width,
   * height, a binary array (1 for the pixels that are part of the
   * person, and 0 otherwise) and 2D pose. The array size corresponds to the
   * number of pixels in the image. The width and height correspond to the
   * dimensions of the image the binary array is shaped to, which are
   * the same dimensions of the input image.
   */
  async segmentMultiPerson(
    input: BodyPixInput,
    config: MultiPersonInstanceInferenceConfig =
      MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):
    Promise<PersonSegmentation[]> {
      config = { ...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,
        ...config };
      validateMultiPersonInstanceInferenceConfig(config);
      const [height, width] =
        getInputSize(input);
      const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(
        config.internalResolution, this.baseModel.outputStride,
        [height, width]);
      const { resized, padding } =
        padAndResizeTo(input, internalResolutionHeightAndWidth);
      const {
        segmentation,
        longOffsets,
        heatmapScoresRaw,
        offsetsRaw,
        displacementFwdRaw,
        displacementBwdRaw,
      } = tf.tidy(() =>
        {
          const {
            segmentLogits,
            longOffsets,
            heatmapScores,
            offsets,
            displacementFwd,
            displacementBwd,
          } =
            this.predictForMultiPersonInstanceSegmentationAndPart(resized);
          const scaledSegmentScores =
            scaleAndCropToInputTensorShape(
              segmentLogits, [height, width], internalResolutionHeightAndWidth,
              [[padding.top, padding.bottom], [padding.left, padding.right]],
              APPLY_SIGMOID_ACTIVATION);

```

```

const longOffsetsResized = false;\n    let scaledLongOffsets;\n    if (longOffsetsResized) {\n    scaledLongOffsets = scaleAndCropToInputTensorShape(\n        longOffsets, [height, width],\n    internalResolutionHeightAndWidth,\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n    APPLY_SIGMOID_ACTIVATION);\n    } else {\n    scaledLongOffsets = longOffsets;\n    }\n\n    const\n    segmentation = toMaskTensor(\n        tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n    return {\n    segmentation,\n    longOffsets: scaledLongOffsets,\n    heatmapScoresRaw: heatmapScores,\n    offsetsRaw: offsets,\n    displacementFwdRaw: displacementFwd,\n    displacementBwdRaw:\n    displacementBwd,\n    };\n\n    const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScoresRaw,\n    offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n    const [scoresBuf, offsetsBuf,\n    displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n\n    let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride,\n    config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n    poses = scaleAndFlipPoses(\n    poses, [height, width], internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n    const instanceMasks = await decodePersonInstanceMasks(\n    segmentation, longOffsets, poses, height, width,\n    this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n    config.scoreThreshold,\n    config.refineSteps, config.minKeypointScore,\n    config.maxDetections);\n\n    resized.dispose();\n    segmentation.dispose();\n    longOffsets.dispose();\n    heatmapScoresRaw.dispose();\n    offsetsRaw.dispose();\n    displacementFwdRaw.dispose();\n    displacementBwdRaw.dispose();\n\n    return instanceMasks;\n    }\n\n    /**\n     * Given an image with many people, returns a dictionary containing: height,\n     * width, a tensor with a part id from 0-24 for the pixels that are\n     * part of a corresponding body part, and -1 otherwise. This does standard\n     * ImageNet pre-processing before inferring through the model. The image\n     * should pixels should have values [0-255].\n     *\n     * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement\n     * The input image to feed through the network.\n     *\n     * @param internalResolution Defaults to 'medium'. The internal\n     * resolution\n     * percentage that the input is resized to before inference. The larger the\n     * internalResolution the more accurate the model at the cost of slower\n     * prediction times. Available values are 'low', 'medium', 'high',\n     * 'full', or\n     * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n     * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n     *\n     * @param segmentationThreshold The minimum that segmentation values\n     * must have\n     * to be considered part of the person. Affects the clipping of the colored\n     * part image.\n     *\n     * @return A dictionary containing `partSegmentation`, `heatmapScores`,\n     * `offsets`, and `padding`:\n     * -\n     * `partSegmentation`: A 2d Tensor with a part id from 0-24 for\n     * the pixels that are part of a corresponding body part, and -1 otherwise.\n     * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n     * single-person pose estimation decoding.\n     * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose\n     * estimation decoding.\n     * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement\n     * used by\n     * pose estimation decoding.\n     * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n     * by\n     * pose estimation decoding.\n     * - `padding`: The padding (unit pixels) being applied to the input image\n     * before it is fed into the model.\n     *\n     */\n    segmentPersonPartsActivation(\n    input: BodyPixInput,\n    internalResolution: BodyPixInternalResolution,\n    segmentationThreshold = 0.5): {\n    partSegmentation:\n    tf.Tensor2D,\n    heatmapScores: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    padding: Padding,\n    internalResolutionHeightAndWidth: [number, number]\n    }\n\n    const [height, width] = getInputSize(input);\n    const internalResolutionHeightAndWidth =\n    toInputResolutionHeightAndWidth(\n    internalResolution, this.baseModel.outputStride, [height, width]);\n\n    const {\n    resized,\n    padding,\n    } = padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n    const\n    {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n    } =\n    tf.tidy(() => {\n    const {\n    segmentLogits,\n    partHeatmapLogits,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n    } = this.predictForPersonSegmentationAndPart(resized);\n\n    const [resizedHeight, resizedWidth] = resized.shape;\n\n    const scaledSegmentScores =\n    scaleAndCropToInputTensorShape(\n    segmentLogits, [height, width], [resizedHeight, resizedWidth],\n    [[padding.top, padding.bottom], [padding.left, padding.right]],\n    APPLY_SIGMOID_ACTIVATION);\n
```

```

const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n      partHeatmapLogits, [height, width],
[resolvedHeight, resolvedWidth],\n      [[padding.top, padding.bottom], [padding.left, padding.right]]);\n
APPLY_SIGMOID_ACTIVATION);\n  const segmentation =\n
toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n  return {\n    partSegmentation:\n      decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      });\n  }\n  resized.dispose();\n  return {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n  };\n  }\n  /**\n   * Given an image with many people,
returns a PartSegmentation dictionary that\n   * contains the body part segmentation mask for all people and a single
pose.\n   *\n   * Note: The body part segmentation mask returned by this method covers all\n   * people but the pose
works well when there is one person. If you want to\n   * estimate instance-level multiple person body part
segmentation & pose for\n   * each person, use `segmentMultiPersonParts` instead.\n   *\n   * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n   * The input image to feed
through the network.\n   *\n   * @param config PersonInferenceConfig object that contains\n   * parameters for the
BodyPix inference using single person decoding.\n   *\n   * @return A SemanticPartSegmentation dictionary that
contains height, width,\n   * the flattened binary segmentation mask and the pose for the person. The\n   * width and
height correspond to the same dimensions of the input image.\n   * - `height`: The height of the person part
segmentation data in pixel unit.\n   * - `width`: The width of the person part segmentation data in pixel unit.\n   * -
`data`: The flattened Int32Array of person part segmentation data with a\n   * part id from 0-24 for the pixels that are
part of a corresponding body\n   * part, and -1 otherwise. The size of the array is equal to `height` x\n   * `width` in
row-major order.\n   * - `allPoses`: The 2d poses of all people.\n   */\n  async segmentPersonParts(\n    input:
BodyPixInput,\n    config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n
Promise<SemanticPartSegmentation> {\n    config = {...PERSON_INFERENCE_CONFIG, ...config};\n    validatePersonInferenceConfig(config);\n    const {\n      partSegmentation,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n      padding,\n      internalResolutionHeightAndWidth\n    } =\n
this.segmentPersonPartsActivation(\n      input, config.internalResolution, config.segmentationThreshold);\n    const [height, width] = partSegmentation.shape;\n    const data = await partSegmentation.data() as Int32Array;\n    partSegmentation.dispose();\n    const tensorBuffers = await toTensorBuffers3D(\n      [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n    const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n      tensorBuffers;\n    let poses = decodeMultiplePoses(\n      scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n      this.baseModel.outputStride, config.maxDetections,\n      config.scoreThreshold, config.nmsRadius);\n    poses = scaleAndFlipPoses(\n      poses, [height, width],
internalResolutionHeightAndWidth, padding,\n      FLIP_POSES_AFTER_SCALING);\n    heatmapScores.dispose();\n    offsets.dispose();\n    displacementFwd.dispose();\n    displacementBwd.dispose();\n    return {height, width, data, allPoses: poses};\n  };\n  /**\n   * Given an image with multiple people, returns an
array* of PartSegmentation\n   * object. Each element in the array corresponding to one\n   * of the people in the
input image. In other words, it predicts\n   * instance-level multiple person body part segmentation & pose for
each\n   * person.\n   *\n   * This does standard ImageNet pre-processing before inferring through\n   * the model.
The image pixels should have values [0-255].\n   *\n   * @param input\n   *
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n   * image to feed
through the network.\n   *\n   * @param config MultiPersonInferenceConfig object that contains\n   * parameters for the
BodyPix inference using multi-person decoding.\n   *\n   * @return An array of PartSegmentation object, each
containing a width,\n   * height, a flattened array (with part id from 0-24 for the pixels that are\n   * part of a
corresponding body part, and -1 otherwise) and 2D pose. The width\n   * and height correspond to the dimensions of
the image. Each flattened part\n   * segmentation array size is equal to `height` x `width`.\n   */\n  async
segmentMultiPersonParts(\n    input: BodyPixInput,\n    config: MultiPersonInstanceInferenceConfig =\n
MULTI_PERSON_INSTANCE_INFERENCE_CONFIG): Promise<PartSegmentation[]> {\n    config =
{...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG, ...config};\n

```

```

validateMultiPersonInstanceInferenceConfig(config);\n  const [height, width] = getInputSize(input);\n  const\n  internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n    config.internalResolution,\n    this.baseModel.outputStride,\n    [height, width]);\n  const {resized, padding} =\n    padAndResizeTo(input,\n    internalResolutionHeightAndWidth);\n  const {\n    segmentation,\n    longOffsets,\n    heatmapScoresRaw,\n    offsetsRaw,\n    displacementFwdRaw,\n    displacementBwdRaw,\n    partSegmentation,\n  } = tf.tidy(() =>\n    {\n      const {\n        segmentLogits,\n        longOffsets,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        partHeatmaps\n      } =\n        this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n      // decoding with scaling.\n      const\n      scaledSegmentScores = scaleAndCropToInputTensorShape(\n        segmentLogits, [height, width],\n        internalResolutionHeightAndWidth,\n        [[padding.top, padding.bottom], [padding.left, padding.right]],\n        APPLY_SIGMOID_ACTIVATION);\n      // decoding with scaling.\n      const scaledPartSegmentationScores =\n        scaleAndCropToInputTensorShape(\n          partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n          [[padding.top, padding.bottom], [padding.left, padding.right]],\n          APPLY_SIGMOID_ACTIVATION);\n      const scaledLongOffsets = longOffsets;\n      const segmentation = toMaskTensor(\n        tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n      const partSegmentation =\n        decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n      return {\n        segmentation,\n        longOffsets:\n        scaledLongOffsets,\n        heatmapScoresRaw: heatmapScores,\n        offsetsRaw: offsets,\n        displacementFwdRaw: displacementFwd,\n        displacementBwdRaw: displacementBwd,\n        partSegmentation\n      };\n    });\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScoresRaw,\n    offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n  const [scoresBuf, offsetsBuf,\n    displacementsFwdBuf, displacementsBwdBuf] =\n    tensorBuffers;\n  let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride,\n    config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n  poses = scaleAndFlipPoses(\n    poses, [height, width], internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n  const instanceMasks = await decodePersonInstancePartMasks(\n    segmentation, longOffsets, partSegmentation,\n    poses, height, width,\n    this.baseModel.outputStride, internalResolutionHeightAndWidth, padding,\n    config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n    config.maxDetections);\n  resized.dispose();\n  segmentation.dispose();\n  longOffsets.dispose();\n  heatmapScoresRaw.dispose();\n  offsetsRaw.dispose();\n  displacementFwdRaw.dispose();\n  displacementBwdRaw.dispose();\n  partSegmentation.dispose();\n  return instanceMasks;\n}\n\npublic dispose() {\n  this.baseModel.dispose();\n}\n\n/**\n * Loads the MobileNet BodyPix model.\n */\n\n@nasync function loadMobileNet(config: ModelConfig):\n  Promise<BodyPix> {\n  const outputStride = config.outputStride;\n  const quantBytes = config.quantBytes;\n  const\n  multiplier = config.multiplier;\n  if (tf == null) {\n    throw new Error(\n      `Cannot find TensorFlow.js. If you are\n      using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the page before using this\n      model.`);\n  }\n  const url = mobileNetSavedModel(outputStride, multiplier, quantBytes);\n  const graphModel = await\n  tfconv.loadGraphModel(config.modelUrl || url);\n  const mobilenet = new MobileNet(graphModel, outputStride);\n  return new BodyPix(mobilenet);\n}\n\n/**\n * Loads the ResNet BodyPix model.\n */\n\n@nasync function\n  loadResNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride = config.outputStride;\n  const\n  quantBytes = config.quantBytes;\n  if (tf == null) {\n    throw new Error(\n      `Cannot find TensorFlow.js. If you\n      are using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the page before using this\n      model.`);\n  }\n  const url = resNet50SavedModel(outputStride, quantBytes);\n  const graphModel = await\n  tfconv.loadGraphModel(config.modelUrl || url);\n  const resnet = new ResNet(graphModel, outputStride);\n  return\n  new BodyPix(resnet);\n}\n\n/**\n * Loads the BodyPix model instance from a checkpoint, with the ResNet * or\n * MobileNet architecture. The model to be loaded is configurable using the\n * config dictionary ModelConfig. Please\n * find more details in the\n * documentation of the ModelConfig.\n * @param config ModelConfig dictionary that\n * contains parameters for\n * the BodyPix loading process. Please find more details of each parameters\n * in the\n * documentation of the ModelConfig interface. The predefined\n * `MOBILENET_V1_CONFIG` and\n * `RESNET_CONFIG` can also be used as references\n * for defining your customized config.\n */\n\nexport async

```

```
function load(config: ModelConfig = MOBILENET_V1_CONFIG):\n Promise<BodyPix> {\n config =
validateModelConfig(config);\n if (config.architecture === 'ResNet50') {\n return loadResNet(config);\n } else if
(config.architecture === 'MobileNetV1') {\n return loadMobileNet(config);\n } else {\n return null;\n
}\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\n// method copied from bGluR in https://codepen.io/zhaojun/pen/zZmRQe\nexport function cpuBlur(\n
canvas: HTMLCanvasElement|OffscreenCanvas,\n image:
HTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n blur: number) {\n const
ctx = canvas.getContext('2d');\n let sum = 0;\n const delta = 5;\n const alphaLeft = 1 / (2 * Math.PI * delta *
delta);\n const step = blur < 3 ? 1 : 2;\n for (let y = -blur; y <= blur; y += step) {\n for (let x = -blur; x <= blur; x
+= step) {\n const weight =\n alphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n sum +=
weight;\n }\n }\n for (let y = -blur; y <= blur; y += step) {\n for (let x = -blur; x <= blur; x += step) {\n
ctx.globalAlpha = alphaLeft *\n Math.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n
ctx.drawImage(image, x, y);\n }\n }\n ctx.globalAlpha = 1;\n}\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from
 './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}
from './util';\nexport type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\nconst offScreenCanvases:
{[name: string]: Canvas} = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype
HasDimensions = {\n width: number,\n height: number\n};\n\nfunction isSafari() {\n return
(/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n {width:
widthA, height: heightA}: HasDimensions,\n {width: widthB, height: heightB}: HasDimensions, nameA: string,\n
nameB: string) {\n if (widthA !== widthB || heightA !== heightB) {\n throw new Error(`error: dimensions must
match. ${nameA} has dimensions ${\n widthA}x${heightA}, ${nameB} has dimensions
${widthB}x${heightB}`);\n }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n const ctx =
canvas.getContext('2d');\n ctx.scale(-1, 1);\n ctx.translate(-canvas.width, 0);\n}\n\nfunction
drawWithCompositing(\n ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n image:
Canvas|ImageType,\n compositeOperation: string) {\n ctx.globalCompositeOperation = compositeOperation;\n
ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n if (typeof document !==
'undefined') {\n return document.createElement('canvas');\n } else if (typeof OffscreenCanvas !== 'undefined')
{\n return new OffscreenCanvas(0, 0);\n } else {\n throw new Error('Cannot create a canvas in this context');\n
}\n}\n\nfunction ensureOffscreenCanvasCreated(id: string): Canvas {\n if (!offScreenCanvases[id]) {\n
offScreenCanvases[id] = createOffScreenCanvas();\n }\n return offScreenCanvases[id];\n}\n\nfunction
drawAndBlurImageOnCanvas(\n image: ImageType, blurAmount: number, canvas: Canvas) {\n const {height,
width} = image;\n const ctx = canvas.getContext('2d');\n canvas.width = width;\n canvas.height = height;\n
ctx.clearRect(0, 0, width, height);\n ctx.save();\n if (isSafari()) {\n cpuBlur(canvas, image, blurAmount);\n } else
{\n // tslint:disable:no-any\n (ctx as any).filter = `blur(${blurAmount}px)`;\n ctx.drawImage(image, 0, 0,
```

```

width, height);\n }\n ctx.restore();\n}\n\nfunction drawAndBlurImageOnOffScreenCanvas(\n  image: ImageType,\n  blurAmount: number,\n  offscreenCanvasName: string): Canvas {\n  const canvas =\n  ensureOffscreenCanvasCreated(offscreenCanvasName);\n  if (blurAmount === 0) {\n  renderImageToCanvas(image, canvas);\n  } else {\n  drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n  }\n  return canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n  const {width,\n  height} = image;\n  canvas.width = width;\n  canvas.height = height;\n  const ctx = canvas.getContext('2d');\n  ctx.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\nfunction\n  renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n  canvas.width = image.width;\n  canvas.height\n  = image.height;\n  const ctx = canvas.getContext('2d');\n  ctx.putImageData(image, 0, 0);\n}\n\nfunction\n  renderImageDataToOffScreenCanvas(\n  image: ImageData, canvasName: string): Canvas {\n  const canvas =\n  ensureOffscreenCanvasCreated(canvasName);\n  renderImageDataToCanvas(image, canvas);\n  return\n  canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with\n  foreground and background color at each pixel determined by the\n * corresponding binary segmentation value at\n  the pixel from the output. In\n * other words, pixels where there is a person will be colored with foreground\n * color and where there is not a person will be colored with background color.\n */\n * @param\n  personOrPartSegmentation The output from\n * `segmentPerson`, `segmentMultiPerson`,\n * `segmentPersonParts`\n  or `segmentMultiPersonParts`. They can\n * be SemanticPersonSegmentation object, an array of\n  PersonSegmentation object,\n * SemanticPartSegmentation object, or an array of PartSegmentation object.\n * @param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground color\n * (r,g,b,a) for visualizing pixels that\n  belong to people.\n * @param background Default to {r:0, g:0, b:0, a: 255}. The background color\n * (r,g,b,a)\n  for visualizing pixels that don't belong to people.\n * @param drawContour Default to false. Whether to draw\n  the contour around each\n * person's segmentation mask or body part mask.\n * @param foregroundIds Default\n  to [1]. The integer values that represent\n * foreground. For person segmentation, 1 is the foreground. For body\n  part\n * segmentation, it can be a subset of all body parts ids.\n * @returns An ImageData with the same width\n  and height of\n * all the PersonSegmentation in multiPersonSegmentation, with opacity and\n * transparency at each\n  pixel determined by the corresponding binary\n * segmentation value at the pixel from the output.\n */\nexport\n  function toMask(\n  personOrPartSegmentation: SemanticPersonSegmentation|\n  SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n  foreground: Color = {\n  r: 0,\n  g:\n  0,\n  b: 0,\n  a: 0\n  },\n  background: Color = {\n  r: 0,\n  g: 0,\n  b: 0,\n  a: 255\n  },\n  drawContour = false, foregroundIds: number[] = [1]): ImageData {\n  if (Array.isArray(personOrPartSegmentation)\n  &&\n  personOrPartSegmentation.length === 0) {\n  return null;\n  }\n  let multiPersonOrPartSegmentation:\n  Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n  PersonSegmentation|PartSegmentation>;\n  if (!Array.isArray(personOrPartSegmentation)) {\n  multiPersonOrPartSegmentation = [personOrPartSegmentation];\n  } else {\n  multiPersonOrPartSegmentation =\n  personOrPartSegmentation;\n  }\n  const {width, height} = multiPersonOrPartSegmentation[0];\n  const bytes =\n  new Uint8ClampedArray(width * height * 4);\n  function drawStroke(\n  bytes: Uint8ClampedArray, row:\n  number, column: number, width: number,\n  radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {\n  for (let i = -radius; i <= radius; i++) {\n  for (let j = -radius; j <= radius; j++) {\n  if (i !== 0 && j !== 0) {\n  const n = (row + i) * width + (column + j);\n  bytes[4 * n + 0] = color.r;\n  bytes[4 * n + 1] = color.g;\n  bytes[4 * n + 2] = color.b;\n  bytes[4 * n + 3] = color.a;\n  }\n  }\n  }\n  }\n  function\n  isSegmentationBoundary(\n  segmentationData: Uint8Array|Int32Array,\n  row: number,\n  column:\n  number,\n  width: number,\n  foregroundIds: number[] = [1],\n  radius = 1,\n  ): boolean {\n  let\n  numberBackgroundPixels = 0;\n  for (let i = -radius; i <= radius; i++) {\n  for (let j = -radius; j <= radius; j++)\n  {\n  if (i !== 0 && j !== 0) {\n  const n = (row + i) * width + (column + j);\n  if\n  (!foregroundIds.some(id => id === segmentationData[n])) {\n  numberBackgroundPixels += 1;\n  }\n  }\n  }\n  }\n  return numberBackgroundPixels > 0;\n  }\n  for (let i = 0; i < height; i += 1) {\n  for (let j = 0; j\n  < width; j += 1) {\n  const n = i * width + j;\n  bytes[4 * n + 0] = background.r;\n  bytes[4 * n + 1] =\n  background.g;\n  bytes[4 * n + 2] = background.b;\n  bytes[4 * n + 3] = background.a;\n  for (let k = 0; k <

```



```

* @param maskImage An ImageData containing the mask. Ideally this should be
* generated by toColoredPartMask.
* @param maskOpacity The opacity of the mask when drawing it on top of the
* image. Defaults to 0.7. Should be a float between 0 and 1.
* @param maskBlurAmount How many pixels to blur the mask by. Defaults to 0.
* Should be an integer between 0 and 20.
* @param flipHorizontal If the result should be flipped horizontally. Defaults
* to false.
* @param pixelCellWidth The width of each pixel cell. Default to 10 px.
*/
export function drawPixelatedMask(
  canvas: Canvas, image: ImageType,
  maskImage: ImageData,
  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,
  pixelCellWidth = 10.0) {
  const [height, width] = getInputSize(image);
  assertSameDimensions({ width, height }, maskImage,
  'image', 'mask');
  const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);
  const blurredMask = drawAndBlurImageOnOffScreenCanvas(
    mask, maskBlurAmount,
    CANVAS_NAMES.blurredMask);
  canvas.width = blurredMask.width;
  canvas.height = blurredMask.height;
  const ctx = canvas.getContext('2d');
  ctx.save();
  if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  const offscreenCanvas =
  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);
  const offscreenCanvasCtx =
  offscreenCanvas.getContext('2d');
  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);
  offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);
  offscreenCanvasCtx.drawImage(
  blurredMask, 0, 0, blurredMask.width, blurredMask.height, 0, 0,
  offscreenCanvas.width,
  offscreenCanvas.height);
  ctx.imageSmoothingEnabled = false;
  ctx.drawImage(
  offscreenCanvas, 0, 0,
  offscreenCanvas.width, offscreenCanvas.height, 0, 0,
  canvas.width, canvas.height);
  // Draws vertical grid
  lines that are `pixelCellWidth` apart from each other.
  for (let i = 0; i < offscreenCanvas.width; i++) {
    ctx.beginPath();
    ctx.strokeStyle = '#ffffff';
    ctx.moveTo(pixelCellWidth * i, 0);
    ctx.lineTo(pixelCellWidth
  * i, canvas.height);
    ctx.stroke();
  }
  // Draws horizontal grid lines that are `pixelCellWidth` apart from
  each
  // other.
  for (let i = 0; i < offscreenCanvas.height; i++) {
    ctx.beginPath();
    ctx.strokeStyle =
  '#ffffff';
    ctx.moveTo(0, pixelCellWidth * i);
    ctx.lineTo(canvas.width, pixelCellWidth * i);
    ctx.stroke();
  }
  ctx.globalAlpha = 1.0 - maskOpacity;
  ctx.drawImage(image, 0, 0, blurredMask.width,
  blurredMask.height);
  ctx.restore();
}

function createPersonMask(
  multiPersonSegmentation:
  PersonSegmentation[]|SemanticPersonSegmentation,
  edgeBlurAmount: number): Canvas {
  const
  backgroundMaskImage = toMask(
  multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},
  {r: 0, g: 0, b: 0, a:
  0});
  const backgroundMask =
  renderImageDataToOffScreenCanvas(backgroundMaskImage,
  CANVAS_NAMES.mask);
  if (edgeBlurAmount === 0) {
    return backgroundMask;
  } else {
    return
  drawAndBlurImageOnOffScreenCanvas(
    backgroundMask, edgeBlurAmount,
    CANVAS_NAMES.blurredMask);
  }
}

/**
 * Given a personSegmentation and an image, draws the image
 * with its background
 * blurred onto the canvas.
 * @param canvas The canvas to draw the background-blurred
 * image onto.
 * @param image The image to blur the background of and draw.
 * @param
 * personSegmentation A SemanticPersonSegmentation or an array of
 * PersonSegmentation object.
 * @param
 * backgroundBlurAmount How many pixels in the background blend into each
 * other. Defaults to 3. Should be an
 * integer between 1 and 20.
 * @param edgeBlurAmount How many pixels to blur on the edge between the
 * person
 * and the background by. Defaults to 3. Should be an integer between 0 and 20.
 * @param
 * flipHorizontal If the output should be flipped horizontally. Defaults
 * to false.
 */
export function
  drawBokehEffect(
  canvas: Canvas, image: ImageType,
  multiPersonSegmentation:
  SemanticPersonSegmentation|PersonSegmentation[],
  backgroundBlurAmount = 3, edgeBlurAmount = 3,
  flipHorizontal = false) {
  const blurredImage = drawAndBlurImageOnOffScreenCanvas(
  image,
  backgroundBlurAmount, CANVAS_NAMES.blurred);
  canvas.width = blurredImage.width;
  canvas.height =
  blurredImage.height;
  const ctx = canvas.getContext('2d');
  if (Array.isArray(multiPersonSegmentation)
  &&
  multiPersonSegmentation.length === 0) {
    ctx.drawImage(blurredImage, 0, 0);
    return;
  }
  const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);
  ctx.save();
  if
  (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  // draw the original image on the final canvas
  const
  [height, width] = getInputSize(image);
  ctx.drawImage(image, 0, 0, width, height);
  // "destination-in" - "The

```


AAC,KAAK,EAAE,SAAS,CAAC,CAAC,CAAC;gBACHe,IAAM,OAAO,GAAGG,aAAa,CAAC,OAAO,EAAE,C
AAC,CAAC,CAAC;gBAC1C,IAAM,OAAO,GAAG,KAAI,CAAC,KAAK,CAAC,OAAO,CAAC,OAAO,CAakB,
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AAE,CAAC;QACxB,KAAK,IAAI,CAAC,GAAG,CAAC,EAAE,CAAC,GAAG,WAAW,EAAE,CAAC,EAAE,EA
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5B,CAAC,GAAG,IAAI,CAAC,GAAG,CAAC,CAAC,EAAE,KAAK,GAAG,CAAC,CAAC,CAAC;YAC3B,IAAM
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No license file was found, but licenses were detected in source scan.

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D,GAFa,EAaK,EAAY,EAAA,eAAiB,EAaI,GAAM,GAG5C,GAFa,EAaK,EAAY,EAAA,eAAiB,EAaI,EAaK,GAaK,GAKID,MAAO,CAAC,EAAC,EAaE,EAAC,GAGd,SAAS,EAcl,EAaGB,EAa2B,EAC3C,EAa2B,EAC3B,EAa0C,EACpC,EAaM,C,EAACn,C,GAKF,QAR8B,EAAA,EAAA,GAAM,EAAA,EAAA,GACjC,EAAA,EAAA,GAAQ,EAAA,EAAA,GACR,EAAA,EAAA,GAAQ,EAAA,EAAA,GAEL,EAaGB,GACbB,EAa0B,SAAC,GACvB,OAAA,EAAYB,EAAM,CAAC,EAAM,GAaO,CAAC,EAaQ,GAAS,IAE1D,EAaIb,EAAG,EAaIb,EACzC,IAAkB,CACrB,IAAM,EAAY,EACd,EAaU,EAaGB,EAaMB,EAC7C,EAaA,EAaA,CAAC,EAaQ,IAEvC,EAAM,KAaK,GAKb,IAFA,IAAI,GAAQ,EACR,EAaW,EAAA,EACN,EAaI,EAAG,EAaI,EAAM,OAAQ,IAAK,CACrC,IAAM,EAaO,EAaGB,EAaO,EAAM,IAcTc,EAaO,IACT,EAaO,EACP,EAaW,GAGf,OAAO,EAGT,SAAS,EACL,EACA,OADC,EAAA,EAAA,GAaKB,EAAA,EAAA,GAIrB,MAAO,CAFMb,KAaK,OAAO,EAaMB,GAaO,EAAS,GAC/C,KAaK,OAAO,EAaMB,GAaO,EAAS,IAI3E,SAaGB,EACZ,EAa0B,EAC1B,EAAYB,EAaGB,EAae,EACxD,EAaUc,EACvC,EAaQB,OADpB,EAAA,EAAA,GAaU,EAAA,EAAA,QACU,IAAA,IAAA,EAAA,GAUvB,IATA,IAAM,EACF,EAaGB,IAAI,SAAA,GAaK,OAAA,IAAI,WAaW,EAAS,GAaO,KAaK,KAElD,EAaA,EAAA,IAAW,EAAA,EAAA,KAeZ,EAAA,EAAA,SAAA,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAER,EAAA,EAAA,CAAA,EAAA,GAAA,GAAA,GAEE,EAaI,EAAG,EAaI,EAaQ,GAaK,EAC/B,IAAK,IAAI,EAaI,EAAG,EAaI,EAaO,GAaK,EAAG,CACjC,IAAM,EAaI,EAaI,EAaQ,EAETb,GAaA,IADA,EAaA,GACV,CACd,IAAM,EAaO,EAaT,CAAC,EAAG,EAAG,EAAG,GAaI,EAaA,EAaIb,EAC5C,CAAC,EAAM,GAaO,CAAC,EAaQ,GAAS,EAaMB,CAAC,EAaQ,GAC5D,EAaQ,GACR,GAaQ,IAcV,EAaW,GAAM,GAaK,IAM9B,OAAO,EAGT,SAaGB,EACZ,EAa0B,EAC1B,EAa6B,EAAYB,EACtD,EAaE,EAaGB,EAC/B,EAaKB,EACIB,OAfGc,EAAA,EAAA,GAaU,EAAA,EAAA,QAElC,IAAA,IAAA,EAAA,GAWF,IAVA,IAAM,EACF,EAaGB,IAAI,SAAA,GAaK,OAAA,IAAI,WAaW,EAAS,GAaO,MAAM,KAe3D,EAaA,EAAA,IAAW,EAAA,EAAA,KAeZ,EAAA,EAAA,SAAA,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAER,EAAA,EAAA,CAAA,EAAA,GAAA,GAAA,GAGE,EAaI,EAAG,EAaI,EAaQ,GAaK,EAC/B,IAAK,IAAI,EAaI,EAAG,EAaI,EAaO,GAaK,EAAG,CACjC,IAAM,EAaI,EAaI,EAaQ,EAETb,GAaA,IADA,EAaA,GACV,CACd,IAAM,EAaO,EAaT,CAAC,EAAG,EAAG,EAAG,GAaI,EAaA,EAaIb,EAC5C,CAAC,EAAM,GAaO,CAAC,EAaQ,GAAS,EAaMB,CAAC,EAaQ,GAC5D,EAaQ,GACR,GAaQ,IAcV,EAaW,GAAM,GAaK,EAaGB,KAM9C,OAAO,EAjET,QAAA,uBAAA,EAiCA,QAAA,2BAAA;;oECIfA,IAAA,EAAA,QAAA,yBAGA,EAAA,QAAA,gBAEA,EAAA,QAAA,UAEA,SAaGB,EACZ,EAa2B,EAC3B,EAAYB,EAaGB,EAaE,EACxD,EAaUc,EACvC,EAaQB,EACrB,GAaF,QaFg,EAAA,EAAA,GAaU,EAAA,EAAA,GAIP,EAAA,EAAA,MAAC,EAAA,EAAA,GAAY,EAAA,EAAA,GAEB,EAAA,EAAA,MAAA,MAAA,EAAA,GAAC,EAAA,EAAA,GAaW,EAAA,EAAA,GAeZ,EACF,EAAG,QAAQ,EAaA,CAAC,EAaW,EAaU,EAAG,EAaA,gBAK/C,EAaW,IAAI,aAAa,EAaE,EAAA,cAAgB,GAAG,KAaK,GACHE,EAaI,EAAG,EAaI,EAaGB,OAAQ,IAg1C,IAFA,IAAM,EAaA,EAaI,EAAA,cAAgB,EACjC,EAaO,EAaGB,GACpB,EAaK,EAAG,EAaK,EAAA,cAAE,IAAM,CACzC,IAAM,EAaW,EAaK,UAAU,GAC1B,EAAS,EAaKB,EAAL,EAC5B,EAAS,GAaU,EAAS,MAC5B,EAAS,EAAS,GAaK,EAAS,SAAS,EACzC,EAAS,EAAS,GAaK,EAAS,SAAS,EAIVc,IAAA,EAAA,EAaA,SAAA,CAAA,EAAA,GAAA,CAAA,EAAA,GAAA,GAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAGT,EAac,EAAG,OAAO,EAaU,CAAC,EAaC,EAAA,cAAE,IAE/D,EAAA,EAAA,IAAW,EAAA,EAAA,KAeZ,EAaIc,CACrC,cAAE,CAAC,eAAgB,cAAE,SAC/C,YAAa,CAAC,EAAY,GAC1B,SAaU,gyCAcSd,EAaI,KAaK,EAAM,KAaK,EAAM,0EAElB,EAaI,KAaK,EAAM,KAaK,EAAM,2FAIX,EAAY,mGAGV,EAAA,cAAa,6PAOX,EAaW,4DACK,EAAS,GAAG,wDACZ,EAaQ,GAAG,iGAGjC,EAaI,KAaK,EAAM,KAaK,EAAM,6FAElB,EAaI,KAaK,EAAM,KAaK,EAAM,wXAYxB,EAaW,ifAqBrC,OADqB,EAAG,UACJ,cAChB,EAAS,CAAC,EAaC,EAaMB,IAvIjD,QAAA,yBAAA;;k6CCPA,IAAA,EAAA,QAAA,yBACA,EAAA,QAAA,yBAIA,EAAA,QAAA,+BACA,EAAA,QAAA,iCAEA,SAaGB,EACZ,EAa2B,GAC7B,OAAO,EAAG,KACN,WAAM,OAAC,EAAG,KAaK,EAAG,MACd,EAaC,EAAG,OAAO,IAAK,WAGvC,SAaGB,EACZ,EAa2B,EAawB,GACrD,OAAO,EAAG,KACN,WAAM,OAAA,EAAG,IAAI,EAAG,IAAI,EAAG,KAaK,EAAG,MAC3B,EAaC,EAAG,OAAO,IAAK,SAaU,EAAG,IAAI,EAaW,IAAK,KAGxE,SAAS,IACP,MAawB,UAAjB,EAAA,aAGT,SAASb,EACIB,EAa2B,EAa0B,EACrD,EAaGB,EAaE,EAC/B,EAaUc,EAaKB,EACzD,EAaIb,EACjB,OAFC,EAAA,EAAA,GAaU,EAAA,EAaA,eAA8C,IAAA,IAAA,EAAA,SACzD,IAAA,IAAA,EAAA,QAAIb,IAAA,IAAA,EAAA,SACjB,IAAA,IAAA,EAaA,0GAEl,EAaKB,EAAM,OAAO,SAAA,GAAQ,OAAA,EAaK,OAAS,IAIVd,KACI,EAASb,EAAG,KAaK,WA

CIC,IAAM,EAakB,EAAA,yBACpB,EAac,EAAa,EAAiB,EAAQ,EAAO,EAC3D,CAAC,EAAU,GAAU,EAAS,EAAa,EAC3C,GACE,EAac,EAAG,SAAS,qBAC5B,EAagB,OAAQ,EAagB,MACxC,EAagB,OAEpB,OAAO,EAagB,IACnB,SAAC,EAAG,GAAM,OAAA,EAAsB,EAAa,OAI9C,CAAA,EAAM,QAAQ,IAAI,EAAoB,IAAI,SAAA,GAAQ,OAAA,EAak,YAf1D,CAAA,EAAA,iBacF,EACK,EAAA,OAGL,EAAoB,QAAQ,SAAA,GAak,OAAA,EAAE,yBAET,MAAA,CAAA,EAAM,EAAa,eACrB,OADIB,EAAoB,EAAA,OACF,CAAA,EAAM,EAAY,eAApC,EAakB,EAAA,OAExB,EAA0B,EAAA,uBACtB,EAAMB,EAAiB,EAAiB,EAAQ,EAC7D,EAAQ,CAAC,EAAU,GAAU,EAAS,oBAG5C,MAAA,CAAA,EAAO,EAAwB,IAC3B,SAAC,EAAM,GAAM,MAAA,CAAE,KAAl,EAae,KAAM,EAagB,GAAl,MAAK,EAae,OAAM,WAGIE,SAAsB,EACIB,EAA2B,EAC3B,EAA+B,EAae,EAagB,EAC9D,EAagB,EAauC,EACvD,EAAoB,EAAiB,EACrC,OAFiB,EAAA,EAAA,GAAU,EAAA,EAAA,eAC3B,IAAA,IAAA,EAAA,SAAoB,IAAA,IAAA,EAAA,QAAiB,IAAA,IAAA,EAAA,SACrC,IAAA,IAAA,EAAA,4GACI,EAakB,EAAM,OAAO,SAAA,GAAQ,OAAA,EAak,OAAS,IAIvD,KACI,EAAoB,EAAG,KAak,WACHC,IAAM,EAakB,EAAA,yBACpB,EAac,EAAa,EAAiB,EAAQ,EAAO,EAC3D,CAAC,EAAU,GAAU,EAAS,EAAa,EAC3C,GACE,EAac,EAAG,SAAS,qBAC9B,EAagB,OAAQ,EAagB,MACxC,EAagB,OAEIB,OAAO,EAagB,IACnB,SAAC,EAAG,GACA,OAAA,EAA0B,EAAa,EAakB,OAI9D,CAAA,EAAM,QAAQ,IAAI,EAakB,IAAI,SAAA,GAAK,OAAA,EAAE,YAhBID,CAAA,EAAA,iBAeF,EACK,EAAA,OAGL,EAakB,QAAQ,SAAA,GAak,OAaa,EAae,yBAEP,MAAA,CAAA,EAAM,EAAa,eACrB,OADIB,EAAoB,EAAA,OACF,CAAA,EAAM,EAAY,eACd,OADtB,EAakB,EAAA,OACI,CAAA,EAAM,EAAiB,eAA7C,EAAsB,EAAA,OAe5B,EAagC,EAAA,2BAC5B,EAAMB,EAAiB,EACpC,EAAiB,EAAQ,EAAO,EAAQ,CAAC,EAAU,GAAU,EAC7D,oBAGN,MAAA,CAAA,EAAO,EAA8B,IACjC,SAAC,EAAM,GAAM,MAAA,CAAE,KAAM,EAagB,GAAl,KAAl,EAae,OAAM,EAae,MAAK,WAvGIE,QAAA,sBAAA,EAOA,QAAA,0BAAA,EAWA,QAAA,0BAAA,EA2CA,QAAA,8BAAA;;aCIEA,SAAS,EAak,GACZ,OAAO,KAak,MAAM,EAAl,0DAGxB,IAAA,EAAA,WAKE,SAAA,EAAY,EAAiB,GAC3B,KAak,cAAgB,IAAI,MAAM,GAC/B,KAak,kBAAoB,EACzB,KAak,gBAakB,EAkE3B,OA/DS,EAAA,UAAA,QAAP,SAAe,GACb,KAak,gBAagB,KAak,kBAAoB,EAC9C,KAak,KAak,KAak,mBAGV,EAAA,UAAA,QAAP,WACE,IAAM,EAAM,KAak,cAAc,GAl/B,OAHA,KAak,SAAS,EAAG,KAak,oBACtB,KAak,KAAK,GACV,KAak,cAAc,KAak,iBAAMB,GAak,KACzC,GAGF,EAAA,UAAA,MAAP,WACE,OAAkC,IAA3B,KAAK,kBAGP,EAAA,UAAA,KAAP,WACE,OAAO,KAak,iBAAMB,GAG1B,EAAA,UAAA,IAAP,WACE,OAAO,KAak,cAAc,MAAM,EAAG,KAak,iBAAMB,IAGtD,EAAA,UAAA,IAAP,WACE,OAAO,KAak,cAAc,IAGpB,EAAA,UAAA,KAAR,SAAa,GACX,KAAO,EAAl,GAak,KAak,KAak,EAak,GAAl,IACjC,KAak,SAAS,EAAG,EAak,IACtB,EAAl,EAak,IAIL,EAAA,UAAA,KAAR,SAAa,GACX,KAAO,EAAl,GAak,KAak,kBAakB,CACrC,IAAI,EAAl,EAAl,EAIZ,GAHI,EAAl,KAak,kBAAoB,KAak,KAak,EAAG,EAAl,IAChD,KAEG,KAak,KAak,EAAG,GACHb,MAEF,KAak,SAAS,EAAG,GACjB,EAAl,IAIA,EAAA,UAAA,WAAR,SAAMb,GACjB,OAAO,KAak,gBAagB,KAak,cAAc,KAGzC,EAAA,UAAA,KAAR,SAAa,EAaw,GACtB,OAAO,KAak,WAaw,GAak,KAak,WAaw,IAGtC,EAAA,UAAA,SAAR,SAAiB,EAaw,GAC1B,IAAM,EAAl,KAak,cAAc,GAC7B,KAak,cAAc,GAak,KAak,cAAc,GAC3C,KAak,cAAc.GAAK,GAe5B,EA1EA,GAAa,QAAA,QAAA;;oECLb,IAAA,EAAA,QAAA,cAEA,SAAS,EAcl,EAAoB,EAae,EAakB,EACrD,EAA4B,GAM9B,IAlM,IAAA,EAAA,EAAA,MAAC,EAAA,EAAA,GAAQ,EAAA,EAAA,GAEX,GAAe,EACb,EAAS,KAak,IAAI,EAaw,EAoB,GACjD,EAAO,KAak,IAAI,EAaw,EAaqB,EAAG,GACHd,EAaw,EAaq,EAaw,IAAQ,EAAU,CAGvD,IAFA,IAAM,EAAS,KAak,IAAI,EAaw,EAoB,GACjD,EAAO,KAak,IAAI,EAaw,EAaqB,EAAG,GACHd,EAaw,EAaq,EAaw,IAAQ,EAC7C,GAAl,EAAO,IAAI,EAAU,EAAU,GAac,EAAO,CACtD,GAAe,EACf,MAGJ,IAAK,EACH,MAIJ,OAAO,EAQT,SAAgB,EACZ,EAawB,EACxB,GAMF,IAlM,IAAA,EAAA,EAAA,MAAC,EAaa,EAAA,GAAQ,EAAA,EAAA,GAao,EAAA,EAAA,GAehB,EAaq,IAAI,EAAA,QACd,EAAS,EAaq,EAac,SAAC,GAAY,OAAX,EAAA,QAe5B,EAaw,EAAG,EAaw,IAAU,EAC1C,IAAK,IAAI,EAaw,EAAG,EAaw,IAAS,EACzC,IAAK,IAAI,EAAa,EAAG,EAaa,IAAgB,EAAY,CACHe,IAAM,EAaq,EAAO,IAAI,EAAU,EAAU,GAlzC,EAaq,GAKR,EACI,EAAY,EAAO,EAAU,EAAU,EACvC,IACN,EAAM,QAAQ,CAAC,MAAK,EAae,KAAAM,CAAC,SAAQ,EAae,SAAQ,EAae,GAAl,KAM7D,OAAO,EA7BT,QAAA,wBAAA;;oECICA,IAAA,EAAA,QAAA,gBAGA,EAAA,QAAA,UACA,EAAA,QAAA,UAEM,EAAsC,EAAA,WAaw,IACnD,SAAC,OAAC,EAaa,EAAA,GAagB,EAAA,EAAA,GACd,MAAA,CAAE,EAAA,SAAS,GAaiB,EAAA,SAAS,MAEvC,EACF,EAaqB,IAAI,SAAC,GAaqB,OAAlB,EAAA,KAe3B,EACF,EAaqB,IAAI,SAAC,GAek,OADJ,EAAA,KAG/B,SAA

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\n *
=====
\n *
\n * \nimport { Backend, DataId } from './tensor';
\nimport { BackendValues, DataType } from './types';
\n\nexport
const EPSILON_FLOAT32 = 1e-7;
\nexport const EPSILON_FLOAT16 = 1e-4;
\n\n// Required information for all
backends.
\nexport interface BackendTimingInfo {
\n kernelMs: number|{error: string};
\n getExtraProfileInfo?():
string; // a field for additional timing information
\n // e.g. packing / unpacking for WebGL
backend
\n}\n\nexport interface TensorStorage {
\n read(dataId: DataId): Promise<BackendValues>;
\n readSync(dataId: DataId): BackendValues;
\n disposeData(dataId: DataId, force?: boolean): boolean;
\n write(values: BackendValues, shape: number[], dtype: DataType): DataId;
\n move(\n dataId: DataId, values:
BackendValues, shape: number[], dtype: DataType,
\n refCount: number): void;
\n memory(): {unreliable:
boolean}; // Backend-specific information.
\n /** Returns number of data ids currently in the storage. */
\n numDataIds(): number;
\n refCount(dataId: DataId): number;
\n}\n\n/** Convenient class for storing tensor-related


```

first array.\n * \n * @doc {heading: 'Util', namespace: 'util'}\n * \n // tslint:disable-next-line:no-any\nexport function
shuffleCombo(array: any[]|Uint32Array|Int32Array|Float32Array,\n // tslint:disable-next-line:no-any\n
array2: any[]|Uint32Array|Int32Array|Float32Array): void {\n\n if (array.length !== array2.length) {\n throw
Error(\n `Array sizes must match to be shuffled together` +\n `First array length was ${array.length}` +\n
`Second array length was ${array2.length}`);\n }\n let counter = array.length;\n let temp, temp2;\n let index = 0;\n
// While there are elements in the array\n while (counter > 0) {\n // Pick a random index\n index =
(Math.random() * counter) | 0;\n // Decrease counter by 1\n counter--;\n // And swap the last element of each
array with it\n temp = array[counter];\n temp2 = array2[counter];\n array[counter] = array[index];\n
array2[counter] = array2[index];\n array[index] = temp;\n array2[index] = temp2;\n }\n}\n\n/** Clamps a value
to a specified range. *\nexport function clamp(min: number, x: number, max: number): number {\n return
Math.max(min, Math.min(x, max));\n}\n\nexport function nearestLargerEven(val: number): number {\n return val
% 2 === 0 ? val : val + 1;\n}\n\nexport function sum(arr: number[]): number {\n let sum = 0;\n for (let i = 0; i <
arr.length; i++) {\n sum += arr[i];\n }\n return sum;\n}\n\n/**\n * Returns a sample from a uniform [a, b)
distribution.\n * \n * @param a The minimum support (inclusive).\n * @param b The maximum support
(exclusive).\n * @return A pseudorandom number on the half-open interval [a,b).\n *\nexport function
randUniform(a: number, b: number) {\n const r = Math.random();\n return (b * r) + (1 - r) * a;\n}\n\n/** Returns
the squared Euclidean distance between two vectors. *\nexport function distSquared(a: FlatVector, b: FlatVector):
number {\n let result = 0;\n for (let i = 0; i < a.length; i++) {\n const diff = Number(a[i]) - Number(b[i]);\n
result += diff * diff;\n }\n return result;\n}\n\n/**\n * Asserts that the expression is true. Otherwise throws an error
with the\n * provided message.\n * \n * ```js\n * const x = 2;\n * tf.util.assert(x === 2, 'x is not 2');\n * ```\n * \n *
@param expr The expression to assert (as a boolean).\n * @param msg A function that returns the message to report
when throwing an\n * error. We use a function for performance reasons.\n * \n * @doc {heading: 'Util',
namespace: 'util'}\n *\nexport function assert(expr: boolean, msg: () => string) {\n if (!expr) {\n throw new
Error(typeof msg === 'string' ? msg : msg());\n }\n}\n\nexport function assertShapesMatch(\n shapeA: number[],
shapeB: number[], errorMessagePrefix = "): void {\n assert(\n arraysEqual(shapeA, shapeB),\n () =>
errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);\n}\n\nexport function assertNonNull(a:
TensorLike): void {\n assert(\n a != null,\n () => `The input to the tensor constructor must be a non-null
value.`);\n}\n\n// NOTE: We explicitly type out what T extends instead of any so that\n// util.flatten on a nested
array of number doesn't try to infer T as a\n// number[][], causing us to explicitly type util.flatten<number>().\n\n/**\n *
Flattens an arbitrarily nested array.\n * \n * ```js\n * const a = [[1, 2], [3, 4], [5, [6, [7]]]];\n * const flat =
tf.util.flatten(a);\n * console.log(flat);\n * ```\n * \n * @param arr The nested array to flatten.\n * @param result
The destination array which holds the elements.\n * @param skipTypedArray If true, avoids flattening the typed
arrays. Defaults\n * to false.\n * \n * @doc {heading: 'Util', namespace: 'util'}\n *\nexport function nflatten<T
extends number|boolean|string|Promise<number>|TypedArray>(\n arr: T|RecursiveArray<T>, result: T[] = [],
skipTypedArray = false): T[] {\n if (result == null) {\n result = [];\n }\n if (Array.isArray(arr) ||
isTypedArray(arr) && !skipTypedArray) {\n for (let i = 0; i < arr.length; ++i) {\n flatten(arr[i], result,
skipTypedArray);\n }\n } else {\n result.push(arr as T);\n }\n return result;\n}\n\n/**\n * Returns the size
(number of elements) of the tensor given its shape.\n * \n * ```js\n * const shape = [3, 4, 2];\n * const size =
tf.util.sizeFromShape(shape);\n * console.log(size);\n * ```\n * \n * @doc {heading: 'Util', namespace: 'util'}\n *\nexport function sizeFromShape(shape: number[]): number {\n if (shape.length === 0) {\n // Scalar.\n return
1;\n }\n let size = shape[0];\n for (let i = 1; i < shape.length; i++) {\n size *= shape[i];\n }\n return
size;\n}\n\nexport function isScalarShape(shape: number[]): boolean {\n return shape.length === 0;\n}\n\nexport
function arraysEqual(n1: FlatVector, n2: FlatVector) {\n if (n1 === n2) {\n return true;\n }\n if (n1 == null || n2
=== null) {\n return false;\n }\n\n if (n1.length !== n2.length) {\n return false;\n }\n for (let i = 0; i < n1.length;
i++) {\n if (n1[i] !== n2[i]) {\n return false;\n }\n }\n return true;\n}\n\nexport function isInt(a: number):
boolean {\n return a % 1 === 0;\n}\n\nexport function tanh(x: number): number {\n // tslint:disable-next-line:no-
any\n if ((Math as any).tanh !== null) {\n // tslint:disable-next-line:no-any\n return (Math as any).tanh(x);\n }\n
if (x === Infinity) {\n return 1;\n } else if (x === -Infinity) {\n return -1;\n } else {\n const e2x = Math.exp(2

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* x);\n  return (e2x - 1) / (e2x + 1);\n };\n\n\nexport function sizeToSquarishShape(size: number): [number,
number] {\n  const width = Math.ceil(Math.sqrt(size));\n  return [width, Math.ceil(size / width)];\n}\n\n\n/**\n * Creates a new array with randomized indicies to a given quantity.\n * @param number Quantity of how
many shuffled indicies to create.\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function
createShuffledIndices(n: number): Uint32Array {\n  const shuffledIndices = new Uint32Array(n);\n  for (let i = 0; i
< n; ++i) {\n    shuffledIndices[i] = i;\n  }\n  shuffle(shuffledIndices);\n  return shuffledIndices;\n}\n\n\nexport
function rightPad(a: string, size: number): string {\n  if (size <= a.length) {\n    return a;\n  }\n  return a +
'.repeat(size - a.length);\n}\n\n\nexport function repeatedTry(\n  checkFn: () => boolean, delayFn = (counter:
number) => 0,\n  maxCounter?: number): Promise<void> {\n  return new Promise<void>((resolve, reject) => {\n
let tryCount = 0;\n\n  const tryFn = () => {\n    if (checkFn()) {\n      resolve();\n      return;\n    }\n\n
tryCount++;\n\n    const nextBackoff = delayFn(tryCount);\n\n    if (maxCounter != null && tryCount >=
maxCounter) {\n      reject();\n      return;\n    }\n\n    setTimeout(tryFn, nextBackoff);\n  });\n\n  tryFn();\n
});\n}\n\n\n/**\n * Given the full size of the array and a shape that may contain -1 as the\n * implicit dimension,
returns the inferred shape where -1 is replaced.\n * E.g. For shape=[2, -1, 3] and size=24, it will return [2, 4, 3].\n
*\n * @param shape The shape, which may contain -1 in some dimension.\n * @param size The full size (number of
elements) of the array.\n * @return The inferred shape where -1 is replaced with the inferred size.\n */\nexport
function inferFromImplicitShape(\n  shape: number[], size: number): number[] {\n  let shapeProd = 1;\n  let
implicitIdx = -1;\n\n  for (let i = 0; i < shape.length; ++i) {\n    if (shape[i] >= 0) {\n      shapeProd *= shape[i];\n
    } else if (shape[i] === -1) {\n      if (implicitIdx !== -1) {\n        throw Error(\n          `Shapes can only have 1 implicit
size. ` +\n          `Found -1 at dim ${implicitIdx} and dim ${i}`);\n      }\n      implicitIdx = i;\n    } else if (shape[i]
< 0) {\n      throw Error(`Shapes can not be < 0. Found ${shape[i]} at dim ${i}`);\n    }\n  }\n\n  if (implicitIdx === -
1) {\n    if (size > 0 && size !== shapeProd) {\n      throw Error(`Size(${size}) must match the product of shape
${shape}`);\n    }\n    return shape;\n  }\n\n  if (shapeProd === 0) {\n    throw Error(\n      `Cannot infer the missing
size in [${shape}] when ` +\n      `there are 0 elements`);\n  }\n\n  if (size % shapeProd !== 0) {\n    throw Error(\n
`The implicit shape can't be a fractional number. ` +\n      `Got ${size} / ${shapeProd}`);\n  }\n\n  const newShape
= shape.slice();\n  newShape[implicitIdx] = size / shapeProd;\n  return newShape;\n}\n\n\nexport function
parseAxisParam(\n  axis: number|number[], shape: number[]): number[] {\n  const rank = shape.length;\n\n  //
Normalize input\n  axis = axis == null ? shape.map((s, i) => i) : [].concat(axis);\n\n  // Check for valid range\n
assert(\n    axis.every(ax => ax >= -rank && ax < rank),\n    () =>`\n      `All values in axis param must be in
range [-${rank}, ${rank}) but ` +\n      `got axis ${axis}`);\n\n  // Check for only integers\n  assert(\n
axis.every(ax => isInt(ax)),\n    () =>`\n      `All values in axis param must be integers but ` +\n      `got axis
${axis}`);\n\n  // Handle negative axis.\n  return axis.map(a => a < 0 ? rank + a : a);\n}\n\n\n/**\n * Reduces the shape by
removing all dimensions of shape 1.\n */\nexport function squeezeShape(shape: number[], axis?: number[]):\n  {newShape: number[], keptDims: number[]} {\n  const newShape: number[] = [];\n  const keptDims: number[] =
[];\n  const isEmptyArray = axis != null && Array.isArray(axis) && axis.length === 0;\n  const axes = (axis == null
|| isEmptyArray) ?\n    null :\n    parseAxisParam(axis, shape).sort();\n  let j = 0;\n  for (let i = 0; i < shape.length;
++i) {\n    if (axes != null) {\n      if (axes[j] === i && shape[i] !== 1) {\n        throw new Error(\n          `Can't
squeeze axis ${i} since its dim '${shape[i]}' is not 1`);\n      }\n      if ((axes[j] == null || axes[j] > i) && shape[i] ===
1) {\n        newShape.push(shape[i]);\n        keptDims.push(i);\n      }\n      if (axes[j] <= i) {\n        j++;\n      }\n
    }\n    if (shape[i] !== 1) {\n      newShape.push(shape[i]);\n      keptDims.push(i);\n    }\n  }\n  return {newShape,
keptDims};\n}\n\n\nexport function getTypedArrayFromDType<D extends NumericDataType>(\n  dtype: D, size:
number): DataTypeMap[D] {\n  let values = null;\n  if (dtype == null || dtype === 'float32') {\n    values = new
Float32Array(size);\n  } else if (dtype === 'int32') {\n    values = new Int32Array(size);\n  } else if (dtype ===
'bool') {\n    values = new Uint8Array(size);\n  } else {\n    throw new Error(`Unknown data type ${dtype}`);\n  }\n
return values as DataTypeMap[D];\n}\n\n\nexport function getArrayFromDType<D extends DataType>(\n  dtype:
D, size: number): DataTypeMap[D] {\n  let values = null;\n  if (dtype == null || dtype === 'float32') {\n    values =
new Float32Array(size);\n  } else if (dtype === 'int32') {\n    values = new Int32Array(size);\n  } else if (dtype ===

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'bool') {\n  values = new Uint8Array(size);\n } else if (dtype === 'string') {\n  values = new
Array<'string'>(size);\n } else {\n  throw new Error('Unknown data type ${dtype}');\n }\n return values as
DataTypeMap[D];\n}\n\nexport function checkConversionForErrors<D extends DataType>(\n vals:
DataTypeMap[D]|number[], dtype: D): void {\n for (let i = 0; i < vals.length; i++) {\n  const num = vals[i] as
number;\n  if (isNaN(num) || !isFinite(num)) {\n   throw Error('A tensor of type ${dtype} being uploaded
contains ${num}.');\n  }\n }\n}\n\n/** Returns true if the dtype is valid. */\nexport function isValidDtype(dtype:
DataType): boolean {\n return dtype === 'bool' || dtype === 'complex64' || dtype === 'float32' ||\n dtype ===
'int32' || dtype === 'string';\n}\n\n/**\n * Returns true if the new type can't encode the old type without loss of\n *
precision.\n */\nexport function hasEncodingLoss(oldType: DataType, newType: DataType): boolean {\n if
(newType === 'complex64') {\n  return false;\n }\n if (newType === 'float32' && oldType !== 'complex64') {\n
return false;\n }\n if (newType === 'int32' && oldType !== 'float32' && oldType !== 'complex64') {\n  return
false;\n }\n if (newType === 'bool' && oldType === 'bool') {\n  return false;\n }\n return true;\n}\n\nexport
function isArray(a: {}): a is Float32Array|Int32Array|Uint8Array {\n return a instanceof Float32Array || a
instanceof Int32Array ||\n a instanceof Uint8Array;\n}\n\nexport function bytesPerElement(dtype: DataType):
number {\n if (dtype === 'float32' || dtype === 'int32') {\n  return 4;\n } else if (dtype === 'complex64') {\n
return 8;\n } else if (dtype === 'bool') {\n  return 1;\n } else {\n  throw new Error('Unknown dtype ${dtype}');\n
}\n}\n\n/**\n * Returns the approximate number of bytes allocated in the string array - 2\n * bytes per character.
Computing the exact bytes for a native string in JS is\n * not possible since it depends on the encoding of the html
page that serves\n * the website.\n */\nexport function bytesFromStringArray(arr: Uint8Array[]): number {\n if (arr
=== null) {\n  return 0;\n }\n let bytes = 0;\n arr.forEach(x => bytes += x.length);\n return bytes;\n}\n\n/**
Returns true if the value is a string. */\nexport function isString(value: {}): value is string {\n return typeof value
=== 'string' || value instanceof String;\n}\n\nexport function isBoolean(value: {}): boolean {\n return typeof value
=== 'boolean';\n}\n\nexport function isNumber(value: {}): boolean {\n return typeof value ===
'number';\n}\n\nexport function inferDtype(values: TensorLike): DataType {\n if (Array.isArray(values)) {\n
return inferDtype(values[0]);\n }\n if (values instanceof Float32Array) {\n  return 'float32';\n } else if (values
instanceof Int32Array || values instanceof Uint8Array) {\n  return 'int32';\n } else if (isNumber(values)) {\n
return 'float32';\n } else if (isString(values)) {\n  return 'string';\n } else if (isBoolean(values)) {\n  return
'bool';\n }\n return 'float32';\n}\n\nexport function isFunction(f: Function) {\n return !!f && f.constructor && f.call &&
f.apply;\n}\n\nexport function nearestDivisor(size: number, start: number): number {\n for (let i = start; i < size;
++i) {\n  if (size % i === 0) {\n   return i;\n  }\n }\n return size;\n}\n\nexport function computeStrides(shape:
number[]): number[] {\n const rank = shape.length;\n if (rank < 2) {\n  return [];\n }\n\n // Last dimension has
implicit stride of 1, thus having D-1 (instead of D)\n // strides.\n const strides = new Array(rank - 1);\n strides[rank
- 2] = shape[rank - 1];\n for (let i = rank - 3; i >= 0; --i) {\n  strides[i] = strides[i + 1] * shape[i + 1];\n }\n return
strides;\n}\n\nfunction createNestedArray(offset: number, shape: number[], a: TypedArray) {\n const ret = new
Array();\n if (shape.length === 1) {\n  const d = shape[0];\n  for (let i = 0; i < d; i++) {\n   ret[i] = a[offset +
i];\n  }\n } else {\n  const d = shape[0];\n  const rest = shape.slice(1);\n  const len = rest.reduce((acc, c) => acc
* c);\n  for (let i = 0; i < d; i++) {\n   ret[i] = createNestedArray(offset + i * len, rest, a);\n  }\n }\n return
ret;\n}\n\n// Provide a nested array of TypedArray in given shape.\nexport function toNestedArray(shape: number[],
a: TypedArray) {\n if (shape.length === 0) {\n  // Scalar type should return a single number.\n  return a[0];\n }\n
const size = shape.reduce((acc, c) => acc * c);\n if (size === 0) {\n  // A tensor with shape zero should be turned
into empty list.\n  return [];\n }\n if (size !== a.length) {\n  throw new Error(`[${shape}] does not match the
input size ${a.length}.`);\n }\n return createNestedArray(0, shape, a);\n}\n\nexport function
makeOnesTypedArray<D extends DataType>(\n size: number, dtype: D): DataTypeMap[D] {\n const array =
makeZerosTypedArray(size, dtype);\n for (let i = 0; i < array.length; i++) {\n  array[i] = 1;\n }\n return
array;\n}\n\nexport function makeZerosTypedArray<D extends DataType>(\n size: number, dtype: D):
DataTypeMap[D] {\n if (dtype === null || dtype === 'float32' || dtype === 'complex64') {\n  return new
Float32Array(size) as DataTypeMap[D];\n } else if (dtype === 'int32') {\n  return new Int32Array(size) as
DataTypeMap[D];\n } else if (dtype === 'bool') {\n  return new Uint8Array(size) as DataTypeMap[D];\n } else

```



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environment is initialized before flags get registered.\n  if (this.urlFlags[flagName] != null) {\n    const flagValue
= this.urlFlags[flagName];\n    console.warn(\n      `Setting feature override from URL ${flagName}:
${flagValue}.`);\n    this.set(flagName, flagValue);\n  }\n}\n\n async getAsync(flagName: string):
Promise<FlagValue> {\n  if (flagName in this.flags) {\n    return this.flags[flagName];\n  }\n\n  this.flags[flagName] = await this.evaluateFlag(flagName);\n  return this.flags[flagName];\n}\n\n get(flagName:
string): FlagValue {\n  if (flagName in this.flags) {\n    return this.flags[flagName];\n  }\n\n  const flagValue =
this.evaluateFlag(flagName);\n  if (isPromise(flagValue)) {\n    throw new Error(\n      `Flag ${flagName}
cannot be synchronously evaluated. ` +\n      `Please use getAsync() instead.`);\n  }\n\n  this.flags[flagName] =
flagValue as number | boolean;\n\n  return this.flags[flagName];\n}\n\n getNumber(flagName: string): number
{\n  return this.get(flagName) as number;\n}\n\n getBool(flagName: string): boolean {\n  return
this.get(flagName) as boolean;\n}\n\n getFlags(): Flags {\n  return this.flags;\n}\n\n // For backwards
compatibility.\n get features(): Flags {\n  return this.flags;\n}\n\n set(flagName: string, value: FlagValue): void
{\n  if (this.flagRegistry[flagName] == null) {\n    throw new Error(\n      `Cannot set flag ${flagName} as it
has not been registered.`);\n  }\n  this.flags[flagName] = value;\n  if (this.flagRegistry[flagName].setHook !=
null) {\n    this.flagRegistry[flagName].setHook(value);\n  }\n}\n\n private evaluateFlag(flagName: string):
FlagValue|Promise<FlagValue> {\n  if (this.flagRegistry[flagName] == null) {\n    throw new Error(\n
`Cannot evaluate flag '${flagName}': no evaluation function found.`);\n  }\n  return
this.flagRegistry[flagName].evaluationFn();\n}\n\n setFlags(flags: Flags) {\n  this.flags = Object.assign({},
flags);\n}\n\n reset() {\n  this.flags = {};\n  this.urlFlags = {};\n  this.populateURLFlags();\n}\n\n private
populateURLFlags(): void {\n  if (typeof this.global === 'undefined' ||\n    typeof this.global.location ===
'undefined' ||\n    typeof this.global.location.search === 'undefined') {\n    return;\n  }\n\n  const urlParams =
getQueryParams(this.global.location.search);\n  if (TENSORFLOWJS_FLAGS_PREFIX in urlParams) {\n
const keyValues = urlParams[TENSORFLOWJS_FLAGS_PREFIX].split(';');\n    keyValues.forEach(keyValue =>
{\n      const [key, value] = keyValue.split(':') as [string, string];\n      this.urlFlags[key] = parseValue(key,
value);\n    });\n  }\n}\n\n\nexport function getQueryParams(queryString: string): {[key: string]: string} {\n
const params = {};\n  queryString.replace(/(?:&|(?=[^=&]+)(?:=([^\&]*)))/g, (s, ...) => {\n    decodeParam(params,
t[0], t[1]);\n    return t.join('=');\n  });\n  return params;\n}\n\n\nfunction decodeParam(\n  params: {[key: string]:
string}, name: string, value?: string) {\n  params[decodeURIComponent(name)] = decodeURIComponent(value ||
'');\n}\n\n\nfunction parseValue(flagName: string, value: string): FlagValue {\n  value = value.toLowerCase();\n  if
(value === 'true' || value === 'false') {\n    return value === 'true';\n  } else if (`${+ value}` === value) {\n
return +value;\n  }\n  throw new Error(\n    `Could not parse value flag value ${value} for flag
${flagName}.`);\n}\n\n\n/**\n * Returns the current environment (a global singleton).\n *\n * The environment object
contains the evaluated feature values as well as the\n * active platform.\n *\n * @doc {heading: 'Environment'}\n
*\n\nexport function env() {\n  return ENV;\n}\n\n\nexport let ENV: Environment = null;\n\nexport function
setEnvironmentGlobal(environment: Environment) {\n  ENV = environment;\n}\n\n\n", // shim for using process in
browser\n\nvar process = module.exports = {};\n\n\n// cached from whatever global is present so that test runners that
stub it\n\n// don't break things. But we need to wrap it in a try catch in case it is\n\n// wrapped in strict mode code which
doesn't define any globals. It's inside a\n\n// function because try/catches deoptimize in certain engines.\n\n\nvar
cachedSetTimeout;\n\nvar cachedClearTimeout;\n\n\nfunction defaultSetTimeout() {\n  throw new Error('setTimeout
has not been defined');\n}\n\n\nfunction defaultClearTimeout () {\n  throw new Error('clearTimeout has not been
defined');\n}\n\n\n(function () {\n  try {\n    if (typeof setTimeout === 'function') {\n      cachedSetTimeout =
setTimeout;\n    } else {\n      cachedSetTimeout = defaultSetTimeout;\n    }\n  } catch (e) {\n
cachedSetTimeout = defaultSetTimeout;\n  }\n  try {\n    if (typeof clearTimeout === 'function') {\n
cachedClearTimeout = clearTimeout;\n    } else {\n      cachedClearTimeout = defaultClearTimeout;\n    }\n  }
catch (e) {\n    cachedClearTimeout = defaultClearTimeout;\n  }\n}\n\n\n\nfunction runTimeout(fun) {\n  if
(cachedSetTimeout === setTimeout) {\n    //normal environments in sane situations\n    return setTimeout(fun,
0);\n  }\n  // if setTimeout wasn't available but was latter defined\n  if ((cachedSetTimeout === defaultSetTimeout
|| !cachedSetTimeout) && setTimeout) {\n    cachedSetTimeout = setTimeout;\n    return setTimeout(fun, 0);\n

```



```

}
try {
  // when when somebody has screwed with setTimeout but no I.E. maddness
  return
cachedSetTimeout(fun, 0);
} catch(e){
  try {
    // When we are in I.E. but the script has been eveled
    so I.E. doesn't trust the global object when called normally
    return cachedSetTimeout.call(null, fun, 0);
  } catch(e){
    // same as above but when it's a version of I.E. that must have the global object for 'this',
    hopefully our context correct otherwise it will throw a global error
    return cachedSetTimeout.call(this, fun,
0);
  }
}
function runClearTimeout(marker) {
  if (cachedClearTimeout === clearTimeout) {
    //normal enviroments in sane situations
    return clearTimeout(marker);
  }
  // if clearTimeout wasn't
  available but was latter defined
  if ((cachedClearTimeout === defaultClearTimeout || !cachedClearTimeout) &&
clearTimeout) {
    cachedClearTimeout = clearTimeout;
    return clearTimeout(marker);
  }
  try {
    // when when somebody has screwed with setTimeout but no I.E. maddness
    return
cachedClearTimeout(marker);
  } catch (e){
    try {
      // When we are in I.E. but the script has been
      eveled so I.E. doesn't trust the global object when called normally
      return cachedClearTimeout.call(null,
marker);
    } catch (e){
      // same as above but when it's a version of I.E. that must have the global object
      for 'this', hopefully our context correct otherwise it will throw a global error.
      // Some versions of I.E. have
      different rules for clearTimeout vs setTimeout
      return cachedClearTimeout.call(this, marker);
    }
  }
}
var queue = [];
var draining = false;
var currentQueue;
var queueIndex = -1;
function
cleanUpNextTick() {
  if (!draining || !currentQueue) {
    return;
  }
  draining = false;
  if
(currentQueue.length) {
    queue = currentQueue.concat(queue);
  } else {
    queueIndex = -1;
  }
  if
(queue.length) {
    drainQueue();
  }
}
function drainQueue() {
  if (draining) {
    return;
  }
  var timeout = runTimeout(cleanUpNextTick);
  draining = true;
  var len = queue.length;
  while(len) {
    currentQueue = queue;
    queue = [];
    while (++queueIndex < len) {
      if (currentQueue) {
        currentQueue[queueIndex].run();
      }
    }
    queueIndex = -1;
    len = queue.length;
  }
  currentQueue = null;
  draining = false;
  runClearTimeout(timeout);
}
process.nextTick = function (fun)
{
  var args = new Array(arguments.length - 1);
  if (arguments.length > 1) {
    for (var i = 1; i <
arguments.length; i++) {
      args[i - 1] = arguments[i];
    }
  }
  queue.push(new Item(fun, args));
  if (queue.length === 1 && !draining) {
    runTimeout(drainQueue);
  }
};
// v8 likes predictable
objects
function Item(fun, array) {
  this.fun = fun;
  this.array = array;
}
Item.prototype.run = function ()
{
  this.fun.apply(null, this.array);
};
process.title = 'browser';
process.browser = true;
process.env =
{};
process.argv = [];
process.version = ''; // empty string to avoid regexp issues
process.versions =
{};
function noop() {}
process.on = noop;
process.addListener = noop;
process.once = noop;
process.off =
noop;
process.removeListener = noop;
process.removeAllListeners = noop;
process.emit =
noop;
process.prependListener = noop;
process.prependOnceListener = noop;
process.listeners = function
(name) {
  return []
}
process.binding = function (name) {
  throw new Error('process.binding is not
supported');
};
process.cwd = function () {
  return ''
};
process.chdir = function (dir) {
  throw new
Error('process.chdir is not supported');
};
process.umask = function() {
  return 0;
};
/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the
 * "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the
 * License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or
 * agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for
 * the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
// Note that the identifier globalNameSpace is scoped to this module, but will
// always resolve to the same
global object regardless of how the module is
resolved.
tslint:disable-next-line:no-any
let globalNameSpace:
{[_tfGlobals: Map<string, any>];}
export function getGlobalNamespaces():
{[_tfGlobals: Map<string, any>]}
if (globalNameSpace == null) {
  // tslint:disable-next-line:no-any
  let ns:
any;
  if (typeof (window) !== 'undefined') {
    ns = window;
  } else if (typeof (global) !== 'undefined') {
    ns = global;
  } else if (typeof (process) !== 'undefined') {
    ns = process;
  } else if (typeof (self) !==

```



```

Pick<NamedTensorInfoMap, 'a'|'b'>;\n\nexport const Bincount = 'Bincount';\nexport type BincountInputs =
Pick<NamedTensorInfoMap, 'x'|'weights'>;\nexport interface BincountAttrs {\n  size: number;\n}\n\nexport const
BroadcastTo = 'BroadcastTo';\nexport type BroadcastToInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface BroadCastToAttrs {\n  shape: number[];\n  inputShape: number[]; // for gradient\n}\n\nexport const Cast =
'Cast';\nexport type CastInputs = UnaryInputs;\nexport interface CastAttrs {\n  dtype: DataType;\n}\n\nexport const
Ceil = 'Ceil';\nexport type CeilInputs = UnaryInputs;\n\nexport const ClipByValue = 'ClipByValue';\nexport type
ClipByValueInputs = UnaryInputs;\nexport interface ClipByValueAttrs {\n  clipValueMin: number;\n  clipValueMax: number;\n}\n\nexport const Complex = 'Complex';\nexport type ComplexInputs =
Pick<NamedTensorInfoMap, 'real'|'imag'>;\n\nexport const ComplexAbs = 'ComplexAbs';\nexport type
ComplexAbsInputs = UnaryInputs;\n\nexport const Concat = 'Concat';\nexport type ConcatInputs =
TensorInfo[];\nexport interface ConcatAttrs {\n  axis: number;\n}\n\nexport const Conv2D = 'Conv2D';\nexport type
Conv2DInputs = Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Conv2DAttrs {\n  strides: [number,
number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations:
[number, number]|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const Conv2DBackpropFilter =
'Conv2DBackpropFilter';\nexport type Conv2DBackpropFilterInputs = Pick<NamedTensorInfoMap,
'x'|'dy'>;\nexport interface Conv2DBackpropFilterAttrs {\n  strides: [number, number]|number;\n  pad:
'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dimRoundingMode?:
'floor'|'round'|'ceil';\n  filterShape: [number, number, number, number];\n}\n\nexport const Conv2DBackpropInput =
'Conv2DBackpropInput';\nexport type Conv2DBackpropInputInputs = Pick<NamedTensorInfoMap,
'dy'|'filter'>;\nexport interface Conv2DBackpropInputAttrs {\n  strides: [number, number]|number;\n  pad:
'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dimRoundingMode?:
'floor'|'round'|'ceil';\n  inputShape: [number, number, number, number];\n}\n\nexport const Conv3D =
'Conv3D';\nexport type Conv3DInputs = Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Conv3DAttrs
{\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same';\n  dataFormat: 'NDHWC'|'NCDHW';\n  dilations: [number, number, number]|number;\n}\n\nexport const Conv3DBackpropFilterV2 =
'Conv3DBackpropFilterV2';\nexport type Conv3DBackpropFilterV2Inputs = Pick<NamedTensorInfoMap,
'x'|'dy'>;\nexport interface Conv3DBackpropFilterV2Attrs {\n  strides: [number, number, number]|number;\n  pad:
'valid'|'same';\n  filterShape: [number, number, number, number, number];\n}\n\nexport const
Conv3DBackpropInputV2 = 'Conv3DBackpropInputV2';\nexport type Conv3DBackpropInputV2Inputs =\nPick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface Conv3DBackpropInputV2Attrs {\n  strides: [number,
number, number]|number;\n  pad: 'valid'|'same';\n  inputShape: [number, number, number, number,
number];\n}\n\nexport const Cos = 'Cos';\nexport type CosInputs = UnaryInputs;\n\nexport const Cosh =
'Cosh';\nexport type CoshInputs = UnaryInputs;\n\nexport const Cumsum = 'Cumsum';\nexport type CumsumInputs
= Pick<NamedTensorInfoMap, 'x'>;\nexport interface CumsumAttrs {\n  axis: number;\n  exclusive: boolean;\n  reverse: boolean;\n}\n\nexport const CropAndResize = 'CropAndResize';\nexport type CropAndResizeInputs =\nPick<NamedTensorInfoMap, 'image'|'boxes'|'boxInd'>;\nexport interface CropAndResizeAttrs {\n  cropSize:
[number, number];\n  method: 'bilinear'|'nearest';\n  extrapolationValue: number;\n}\n\nexport const DenseBincount
= 'DenseBincount';\nexport type DenseBincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights'>;\nexport
interface DenseBincountAttrs {\n  size: number;\n  binaryOutput?: boolean;\n}\n\nexport const DepthToSpace =
'DepthToSpace';\nexport type DepthToSpaceInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface
DepthToSpaceAttrs {\n  blockSize: number;\n  dataFormat: 'NHWC'|'NCHW';\n}\n\nexport const
DepthwiseConv2dNative = 'DepthwiseConv2dNative';\nexport type DepthwiseConv2dNativeInputs =\nPick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface DepthwiseConv2dNativeAttrs {\n  strides: [number,
number]|number;\n  pad: 'valid'|'same'|number;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number,
number]|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const
DepthwiseConv2dNativeBackpropFilter = 'DepthwiseConv2dNativeBackpropFilter';\nexport type
DepthwiseConv2dNativeBackpropFilterInputs =\nPick<NamedTensorInfoMap, 'x'|'dy'>;\nexport interface
DepthwiseConv2dNativeBackpropFilterAttrs {\n  strides: [number, number]|number;\n  dilations: [number,

```

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number]]number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?: 'floor'|'round'|'ceil';\n filterShape: [number,
number, number, number];\n}\n\n\nexport const DepthwiseConv2dNativeBackpropInput = \n
'DepthwiseConv2dNativeBackpropInput';\nexport type DepthwiseConv2dNativeBackpropInputInputs = \n
Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface DepthwiseConv2dNativeBackpropInputAttrs {\n
strides: [number, number]]number;\n dilations: [number, number]]number;\n pad: 'valid'|'same'|number;\n
dimRoundingMode?: 'floor'|'round'|'ceil';\n inputShape: [number, number, number, number];\n}\n\n\nexport const
Diag = 'Diag';\nexport type DiagInputs = Pick<NamedTensorInfoMap, 'x'>;\n\n\nexport const Dilation2D =
'Dilation2D';\nexport type Dilation2DInputs = Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface
Dilation2DAttrs {\n strides: [number, number]]number;\n pad: 'valid'|'same'|number;\n dilations: [number,
number]]number;\n}\n\n\nexport const Dilation2DBackpropInput = 'Dilation2DBackpropInput';\nexport type
Dilation2DBackpropInputInputs = \n  Pick<NamedTensorInfoMap, 'x'|'filter'|'dy'>;\n\n\nexport const
Dilation2DBackpropFilter = 'Dilation2DBackpropFilter';\nexport type Dilation2DBackpropFilterInputs = \n
Pick<NamedTensorInfoMap, 'x'|'filter'|'dy'>;\n\n\nexport const RealDiv = 'RealDiv';\nexport type RealDivInputs =
BinaryInputs;\n\n\nexport const Elu = 'Elu';\nexport type EluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\n\nexport
const EluGrad = 'EluGrad';\nexport type EluGradInputs = Pick<NamedTensorInfoMap, 'dy'|'y'>;\n\n\nexport const Erf
= 'Erf';\nexport type ErfInputs = UnaryInputs;\n\n\nexport const Equal = 'Equal';\nexport type EqualInputs =
BinaryInputs;\n\n\nexport const Exp = 'Exp';\nexport type ExpInputs = UnaryInputs;\n\n\nexport const ExpandDims =
'ExpandDims';\nexport type ExpandDimsInputs = Pick<NamedTensorInfoMap, 'input'>;\nexport interface
ExpandDimsAttrs {\n dim: number;\n}\n\n\nexport const Expm1 = 'Expm1';\nexport type Expm1Inputs =
UnaryInputs;\n\n\nexport const FFT = 'FFT';\nexport type FFTInputs = Pick<NamedTensorInfoMap,
'input'>;\n\n\nexport const Fill = 'Fill';\nexport interface FillAttrs {\n shape: number[];\n value: number|string;\n
dtype: DataType;\n}\n\n\nexport const FlipLeftRight = 'FlipLeftRight';\nexport type FlipLeftRightInputs =
Pick<NamedTensorInfoMap, 'image'>;\n\n\nexport const Floor = 'Floor';\nexport type FloorInputs =
UnaryInputs;\n\n\nexport const FloorDiv = 'FloorDiv';\nexport type FloorDivInputs = BinaryInputs;\n\n\nexport const
FusedBatchNorm = 'FusedBatchNorm';\nexport type FusedBatchNormInputs = \n  Pick<NamedTensorInfoMap,
'x'|'scale'|'offset'|'mean'|'variance'>;\nexport interface FusedBatchNormAttrs {\n varianceEpsilon:
number;\n}\n\n\nexport const GatherV2 = 'GatherV2';\nexport type GatherV2Inputs = Pick<NamedTensorInfoMap,
'x'|'indices'>;\nexport interface GatherV2Attrs {\n axis: number;\n batchDims: number;\n}\n\n\nexport const
GatherNd = 'GatherNd';\nexport type GatherNdInputs = Pick<NamedTensorInfoMap, 'params'|'indices'>;\n\n\nexport
const Greater = 'Greater';\nexport type GreaterInputs = BinaryInputs;\n\n\nexport const GreaterEqual =
'GreaterEqual';\nexport type GreaterEqualInputs = BinaryInputs;\n\n\nexport const Identity = 'Identity';\nexport type
IdentityInputs = Pick<NamedTensorInfoMap, 'x'>;\n\n\nexport const IFFT = 'IFFT';\nexport type IFFTInputs =
Pick<NamedTensorInfoMap, 'input'>;\n\n\nexport const Imag = 'Imag';\nexport type ImagInputs =
Pick<NamedTensorInfoMap, 'input'>;\n\n\nexport const IsFinite = 'IsFinite';\nexport type IsFiniteInputs =
UnaryInputs;\n\n\nexport const IsInf = 'IsInf';\nexport type IsInfInputs = UnaryInputs;\n\n\nexport const IsNan =
'IsNan';\nexport type IsNanInputs = UnaryInputs;\n\n\nexport const LeakyRelu = 'LeakyRelu';\nexport type
LeakyReluInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface LeakyReluAttrs {\n alpha:
number;\n}\n\n\nexport const Less = 'Less';\nexport type LessInputs = BinaryInputs;\n\n\nexport const LessEqual =
'LessEqual';\nexport type LessEqualInputs = BinaryInputs;\n\n\nexport const LinSpace = 'LinSpace';\nexport interface
LinSpaceAttrs {\n start: number;\n stop: number;\n num: number;\n}\n\n\nexport const Log = 'Log';\nexport type
LogInputs = UnaryInputs;\n\n\nexport const Log1p = 'Log1p';\nexport type Log1pInputs = UnaryInputs;\n\n\nexport
const LogicalAnd = 'LogicalAnd';\nexport type LogicalAndInputs = BinaryInputs;\n\n\nexport const LogicalNot =
'LogicalNot';\nexport type LogicalNotInputs = Pick<NamedTensorInfoMap, 'x'>;\n\n\nexport const LogicalOr =
'LogicalOr';\nexport type LogicalOrInputs = BinaryInputs;\n\n\nexport const LogSoftmax = 'LogSoftmax';\nexport
type LogSoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nexport interface LogSoftmaxAttrs {\n axis:
number;\n}\n\n\nexport const LRN = 'LRN';\nexport type LRNInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface LRNAttrs {\n depthRadius: number;\n bias: number;\n alpha: number;\n beta: number;\n}\n\n\nexport
const LRNGrad = 'LRNGrad';\nexport type LRNGradInputs = Pick<NamedTensorInfoMap, 'x'|'y'|'dy'>;\nexport

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interface LRNGradAttrs {\n depthRadius: number;\n bias: number;\n alpha: number;\n beta:
number;\n}\n\nexport const Max = 'Max';\nexport type MaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface MaxAttrs {\n reductionIndices: number|number[];\n keepDims: boolean;\n}\n\nexport const Maximum =
'Maximum';\nexport type MaximumInputs = BinaryInputs;\n\nexport const MaxPool = 'MaxPool';\nexport type
MaxPoolInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolAttrs {\n filterSize: [number,
number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPoolGrad = 'MaxPoolGrad';\nexport type MaxPoolGradInputs =
Pick<NamedTensorInfoMap, 'dy'|'input'|'output'>;\nexport interface MaxPoolGradAttrs {\n filterSize: [number,
number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPool3D = 'MaxPool3D';\nexport type MaxPool3DInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPool3DAttrs {\n filterSize: [number, number,
number]|number;\n strides: [number, number, number]|number;\n pad: 'valid'|'same'|number;\n dataFormat:
'NDHWC'|'NCDHW';\n dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const MaxPool3DGrad =
'MaxPool3DGrad';\nexport type MaxPool3DGradInputs =\n Pick<NamedTensorInfoMap,
'dy'|'input'|'output'>;\nexport interface MaxPool3DGradAttrs {\n filterSize: [number, number, number]|number;\n
strides: [number, number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nexport const MaxPoolWithArgmax = 'MaxPoolWithArgmax';\nexport type
MaxPoolWithArgmaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MaxPoolWithArgmaxAttrs {\n
filterSize: [number, number]|number;\n strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n
includeBatchInIndex: boolean;\n}\n\nexport const Mean = 'Mean';\nexport type MeanInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface MeanAttrs {\n axis: number|number[];\n keepDims:
boolean;\n}\n\nexport const Min = 'Min';\nexport type MinInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface MinAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\nexport const Minimum =
'Minimum';\nexport type MinimumInputs = BinaryInputs;\n\nexport const MirrorPad = 'MirrorPad';\nexport type
MirrorPadInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface MirrorPadAttrs {\n paddings:
Array<[number, number]>;\n mode: 'reflect'|'symmetric';\n}\n\nexport const Mod = 'Mod';\nexport type ModInputs
= BinaryInputs;\n\nexport const Multinomial = 'Multinomial';\nexport type MultinomialInputs =
Pick<NamedTensorInfoMap, 'logits'>;\nexport interface MultinomialAttrs {\n numSamples: number;\n seed:
number;\n normalized: boolean;\n}\n\nexport const Multiply = 'Multiply';\nexport type MultiplyInputs =
BinaryInputs;\n\nexport const Neg = 'Neg';\nexport type NegInputs = UnaryInputs;\n\nexport const NotEqual =
'NotEqual';\nexport type NotEqualInputs = BinaryInputs;\n\nexport const NonMaxSuppressionV3 =
'NonMaxSuppressionV3';\nexport type NonMaxSuppressionV3Inputs =\n Pick<NamedTensorInfoMap,
'boxes'|'scores'>;\nexport interface NonMaxSuppressionV3Attrs {\n maxOutputSize: number;\n iouThreshold:
number;\n scoreThreshold: number;\n}\n\nexport const NonMaxSuppressionV4 =
'NonMaxSuppressionV4';\nexport type NonMaxSuppressionV4Inputs =\n Pick<NamedTensorInfoMap,
'boxes'|'scores'>;\nexport interface NonMaxSuppressionV4Attrs {\n maxOutputSize: number;\n iouThreshold:
number;\n scoreThreshold: number;\n padToMaxOutputSize: boolean;\n}\n\nexport const NonMaxSuppressionV5
= 'NonMaxSuppressionV5';\nexport type NonMaxSuppressionV5Inputs =\n Pick<NamedTensorInfoMap,
'boxes'|'scores'>;\nexport interface NonMaxSuppressionV5Attrs {\n maxOutputSize: number;\n iouThreshold:
number;\n scoreThreshold: number;\n softNmsSigma: number;\n}\n\nexport const OnesLike = 'OnesLike';\nexport
type OnesLikeInputs = UnaryInputs;\n\nexport const OneHot = 'OneHot';\nexport type OneHotInputs =
Pick<NamedTensorInfoMap, 'indices'>;\nexport interface OneHotAttrs {\n depth: number;\n onValue: number;\n
offValue: number;\n}\n\nexport const Pack = 'Pack';\nexport type PackInputs = TensorInfo[];\nexport interface
PackAttrs {\n axis: number;\n}\n\nexport const PadV2 = 'PadV2';\nexport type PadV2Inputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface PadV2Attrs {\n paddings: Array<[number, number]>;\n
constantValue: number;\n}\n\nexport const Pool = 'Pool';\nexport type PoolInputs = Pick<NamedTensorInfoMap,
'input'>;\n\nexport const Pow = 'Pow';\nexport type PowInputs = BinaryInputs;\n\nexport const Prelu =
'Prelu';\nexport type PreluInputs = Pick<NamedTensorInfoMap, 'x'|'alpha'>;\n\nexport const Prod = 'Prod';\nexport

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type ProdInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface ProdAttrs {\n axis: number|number[];\n
keepDims: boolean;\n}\n\nnextport const Range = 'Range';\nextport interface RangeAttrs {\n start: number;\n stop:
number;\n step: number;\n dtype: 'float32'|'int32';\n}\n\nnextport const Real = 'Real';\nextport type RealInputs =
Pick<NamedTensorInfoMap, 'input'>;\n\nnextport const Reciprocal = 'Reciprocal';\nextport type ReciprocalInputs =
UnaryInputs;\n\nnextport const Relu = 'Relu';\nextport type ReluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nnextport
const Reshape = 'Reshape';\nextport type ReshapeInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface
ReshapeAttrs {\n shape: number[];\n}\n\nnextport const ResizeNearestNeighbor = 'ResizeNearestNeighbor';\nextport
type ResizeNearestNeighborInputs = Pick<NamedTensorInfoMap, 'images'>;\nextport interface
ResizeNearestNeighborAttrs {\n alignCorners: boolean;\n halfPixelCenters: boolean;\n size: [number,
number];\n}\n\nnextport const ResizeNearestNeighborGrad = 'ResizeNearestNeighborGrad';\nextport type
ResizeNearestNeighborGradInputs =\n Pick<NamedTensorInfoMap, 'images'|'dy'>;\nextport type
ResizeNearestNeighborGradAttrs = ResizeNearestNeighborAttrs;\n\nnextport const ResizeBilinear =
'ResizeBilinear';\nextport type ResizeBilinearInputs = Pick<NamedTensorInfoMap, 'images'>;\nextport interface
ResizeBilinearAttrs {\n alignCorners: boolean;\n halfPixelCenters: boolean;\n size: [number,
number];\n}\n\nnextport const ResizeBilinearGrad = 'ResizeBilinearGrad';\nextport type ResizeBilinearGradInputs =
Pick<NamedTensorInfoMap, 'images'|'dy'>;\nextport type ResizeBilinearGradAttrs = ResizeBilinearAttrs;\n\nnextport
const Relu6 = 'Relu6';\nextport type Relu6Inputs = Pick<NamedTensorInfoMap, 'x'>;\n\nnextport const Reverse =
'Reverse';\nextport type ReverseInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface ReverseAttrs {\n dims:
number|number[];\n}\n\nnextport const Round = 'Round';\nextport type RoundInputs = UnaryInputs;\n\nnextport const
Rsqrt = 'Rsqrt';\nextport type RsqrtInputs = UnaryInputs;\n\nnextport const ScatterNd = 'ScatterNd';\nextport type
ScatterNdInputs = Pick<NamedTensorInfoMap, 'indices'|'updates'>;\nextport interface ScatterNdAttrs {\n shape:
number[];\n}\n\nnextport const Select = 'Select';\nextport type SelectInputs = Pick<NamedTensorInfoMap,
'condition'|'t'|'e'>;\n\nnextport const Selu = 'Selu';\nextport type SeluInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nnextport const Slice = 'Slice';\nextport type SliceInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface
SliceAttrs {\n begin: number|number[];\n size: number|number[];\n}\n\nnextport const Sin = 'Sin';\nextport type
SinInputs = UnaryInputs;\n\nnextport const Sinh = 'Sinh';\nextport type SinhInputs = UnaryInputs;\n\nnextport const
Sign = 'Sign';\nextport type SignInputs = UnaryInputs;\n\nnextport const Sigmoid = 'Sigmoid';\nextport type
SigmoidInputs = UnaryInputs;\n\nnextport const Softplus = 'Softplus';\nextport type SoftplusInputs =
UnaryInputs;\n\nnextport const Sqrt = 'Sqrt';\nextport type SqrtInputs = UnaryInputs;\n\nnextport const Sum =
'Sum';\nextport type SumInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface SumAttrs {\n axis:
number|number[];\n keepDims: boolean;\n}\n\nnextport const SpaceToBatchND = 'SpaceToBatchND';\nextport type
SpaceToBatchNDInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface SpaceToBatchNDAttrs {\n
blockShape: number[];\n paddings: number[][];\n}\n\nnextport const SplitV = 'SplitV';\nextport type SplitVInputs =
Pick<NamedTensorInfoMap, 'x'>;\nextport interface SplitVAttrs {\n numOrSizeSplits: number[]|number;\n axis:
number;\n}\n\nnextport const Softmax = 'Softmax';\nextport type SoftmaxInputs = Pick<NamedTensorInfoMap,
'logits'>;\nextport interface SoftmaxAttrs {\n dim: number;\n}\n\nnextport const SquaredDifference =
'SquaredDifference';\nextport type SquaredDifferenceInputs = BinaryInputs;\n\nnextport const Square =
'Square';\nextport type SquareInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nnextport const Sub = 'Sub';\nextport type
SubInputs = BinaryInputs;\n\nnextport const SparseToDense = 'SparseToDense';\nextport type SparseToDenseInputs
=\n Pick<NamedTensorInfoMap, 'sparseIndices'|'sparseValues'|'defaultValue'>;\nextport interface
SparseToDenseAttrs {\n outputShape: number[];\n}\n\nnextport const StridedSlice = 'StridedSlice';\nextport type
StridedSliceInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface StridedSliceAttrs {\n begin: number[];\n
end: number[];\n strides: number[];\n beginMask: number;\n endMask: number;\n ellipsisMask: number;\n
newAxisMask: number;\n shrinkAxisMask: number;\n}\n\nnextport const Tan = 'Tan';\nextport type TanInputs =
UnaryInputs;\n\nnextport const Tanh = 'Tanh';\nextport type TanhInputs = UnaryInputs;\n\nnextport const Tile =
'Tile';\nextport type TileInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface TileAttrs {\n reps:
number[];\n}\n\nnextport const TopK = 'TopK';\nextport type TopKInputs = Pick<NamedTensorInfoMap,
'x'>;\nextport interface TopKAttrs {\n k: number;\n sorted: boolean;\n}\n\nnextport const Transpose =

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'Transpose';\nexport type TransposeInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface TransposeAttrs {\n
perm: number[];\n}\n\nexport const Unique = 'Unique';\nexport type UniqueInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface UniqueAttrs {\n axis: number;\n}\n\nexport type UnaryInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport const Unpack = 'Unpack';\nexport type UnpackInputs =
Pick<NamedTensorInfoMap, 'value'>;\nexport interface UnpackAttrs {\n axis: number;\n}\n\nexport const
UnsortedSegmentSum = 'UnsortedSegmentSum';\nexport type UnsortedSegmentSumInputs =\n
Pick<NamedTensorInfoMap, 'x'|'segmentIds'>;\nexport interface UnsortedSegmentSumAttrs {\n numSegments:
number;\n}\n\nexport const ZerosLike = 'ZerosLike';\nexport type ZerosLikeInputs = UnaryInputs;\n\n/**\n *
TensorFlow.js-only kernels\n */\nexport const Step = 'Step';\nexport type StepInputs = UnaryInputs;\nexport
interface StepAttrs {\n alpha: number;\n}\n\nexport const FromPixels = 'FromPixels';\nexport interface
FromPixelsInputs {\n pixels: PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n
HTMLVideoElement|ImageBitmap;\n}\n\nexport interface FromPixelsAttrs {\n numChannels: number;\n}\n\nexport
const RotateWithOffset = 'RotateWithOffset';\nexport type RotateWithOffsetInputs = Pick<NamedTensorInfoMap,
'image'>;\nexport interface RotateWithOffsetAttrs {\n radians: number;\n fillValue: number|[number, number,
number];\n center: number|[number, number];\n}\n\nexport const _FusedMatMul = '_FusedMatMul';\n//
tslint:disable-next-line: class-name\nexport interface _FusedMatMulInputs extends NamedTensorInfoMap {\n a:
TensorInfo;\n b: TensorInfo;\n bias?: TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n// tslint:disable-
next-line: class-name\nexport interface _FusedMatMulAttrs {\n transposeA: boolean;\n transposeB: boolean;\n
activation: Activation;\n leakyreluAlpha?: number;\n}\n\nexport const FusedConv2D = 'FusedConv2D';\nexport
interface FusedConv2DInputs extends NamedTensorInfoMap {\n x: TensorInfo;\n filter: TensorInfo;\n bias?:
TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedConv2DAAttrs {\n strides: [number,
number]|[number, number];\n pad: 'valid'|'same'|number|ExplicitPadding;\n dataFormat: 'NHWC'|'NCHW';\n dilations:
[number, number]|number;\n dimRoundingMode: 'floor'|'round'|'ceil';\n activation: Activation;\n leakyreluAlpha?:
number;\n}\n\nexport const FusedDepthwiseConv2D = 'FusedDepthwiseConv2D';\nexport interface
FusedDepthwiseConv2DInputs extends NamedTensorInfoMap {\n x: TensorInfo;\n filter: TensorInfo;\n bias?:
TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedDepthwiseConv2DAAttrs {\n
strides: [number, number]|[number, number];\n pad: 'valid'|'same'|number;\n dataFormat: 'NHWC'|'NCHW';\n dilations:
[number, number]|number;\n dimRoundingMode: 'floor'|'round'|'ceil';\n activation: Activation;\n leakyreluAlpha?:
number;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\nimport {env} from './environment';\nimport {getGlobal} from './global_util';\nimport {NamedGradientMap}
from './tape';\nimport {Tensor} from './tensor';\nimport {DataType, RecursiveArray} from './types';\n\nconst
kernelRegistry =\n  getGlobal('kernelRegistry', () => new Map<string, KernelConfig>());\nconst gradRegistry =\n  getGlobal('gradRegistry', () => new Map<string, GradConfig>());\n\nexport type DataId = object;\n\nntype
AttributeValue =\n  number|number[]|boolean|boolean[]|string|string[]|NamedAttrMap;\n\n/** These are extra non-
tensor/primitive params passed to kernel functions. */\nexport type Attribute =
AttributeValue|RecursiveArray<AttributeValue>;\n\n/** Specifies the code to run when executing a kernel.
*/\nexport type KernelFunc = (params: {\n inputs: NamedTensorInfoMap,\n backend: {},\n attrs?:
NamedAttrMap,\n}) => TensorInfo|TensorInfo[];\n\n/** The function to run when computing a gradient during
backprop. */\nexport type GradFunc =\n  (dy: Tensor|Tensor[], saved: Tensor[], attrs: NamedAttrMap) =>\n
NamedGradientMap;\n\n/** Function that gets called after the backend initializes. */\nexport type KernelSetupFunc
= (backend: {}) => void;\n\n/** Function that gets called right before the backend is disposed. */\nexport type

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KernelDisposeFunc = KernelSetupFunc;\n\n/** Config object for registering a kernel in the global registry.
*\nexport interface KernelConfig {\n  kernelName: string;\n  backendName: string;\n  kernelFunc: KernelFunc;\n  setupFunc?: KernelSetupFunc;\n  disposeFunc?: KernelDisposeFunc;\n}\n\n/** Config object for registering a
gradient in the global registry. *\nexport interface GradConfig {\n  kernelName: string;\n  inputsToSave?:
string[];\n  // When saveAllInputs is true, all inputs will be saved. Only use this flag\n  // if inputs is an array of
Tensors.\n  saveAllInputs?: boolean;\n  outputsToSave?: boolean[];\n  gradFunc: GradFunc;\n}\n\n/** Holds
metadata for a given tensor. *\nexport interface TensorInfo {\n  dataId: DataId;\n  shape: number[];\n  dtype:
DataType;\n}\n\nexport interface NamedTensorInfoMap {\n  [name: string]: TensorInfo;\n}\n\nexport interface
NamedAttrMap {\n  [name: string]: Attribute;\n}\n\n/**\n * Returns the kernel function (code) associated with the
provided names.\n * @param kernelName The official name of the kernel.\n * @param backendName The
official name of the backend.\n *\nexport function getKernel(\n  kernelName: string, backendName: string):
KernelConfig {\n  const key = makeKey(kernelName, backendName);\n  return kernelRegistry.get(key);\n}\n\n/**\n * Returns the registered gradient info associated with the provided kernel.\n * @param kernelName The official TF
kernel name.\n *\nexport function getGradient(kernelName: string): GradConfig {\n  return
gradRegistry.get(kernelName);\n}\n\nexport function getKernelsForBackend(backendName: string): KernelConfig[]
{\n  const it = kernelRegistry.entries();\n  const result: KernelConfig[] = [];\n\n  while (true) {\n    const {done,
value} = it.next();\n    if (done) {\n      break;\n    }\n    const [key, config] = value;\n    const [backend, ] =
key.split('_');\n    if (backend === backendName) {\n      result.push(config);\n    }\n  }\n  return result;\n}\n\n/**\n * Registers the function (forward pass) for the kernel in a global registry.\n * @param config A config object with
the following properties:\n * - `kernelName` The official name of the kernel.\n * - `backendName` The official
name of the backend.\n * - `kernelFunc` The function to run during the forward pass of the kernel.\n * - `setupFunc`
Optional. Gets called once, after the backend initializes.\n * - `disposeFunc` Optional. Gets called once, right before
the backend is\n * disposed.\n *\nexport function registerKernel(config: KernelConfig) {\n  const {kernelName,
backendName} = config;\n  const key = makeKey(kernelName, backendName);\n  if (kernelRegistry.has(key)) {\n
console.warn(\n    `The kernel '${kernelName}' for backend ` +\n    ` '${backendName}' is already
registered`);\n  }\n  kernelRegistry.set(key, config);\n}\n\n/**\n * Registers a gradient function for a given kernel in
the global registry,\n * to be used during the back-propagation of that kernel.\n * @param config An object with
the following properties:\n * - `kernelName` The name of the kernel that the gradient function is for.\n * -
`gradFunc` The function to run during back-propagation.\n *\nexport function registerGradient(config: GradConfig)
{\n  const {kernelName} = config;\n\n  if (gradRegistry.has(kernelName)) {\n    // TODO (yassogba) after 3.0 assess
whether we need to keep this gated\n    // to debug mode.\n    if (env().getBool('DEBUG')) {\n
console.warn(`Overriding the gradient for '${kernelName}'`);\n    }\n  }\n  gradRegistry.set(kernelName,
config);\n}\n\n/**\n * Removes the kernel function from the registry.\n * @param kernelName The official
name of the kernel.\n * @param backendName The official name of the backend.\n *\nexport function
unregisterKernel(\n  kernelName: string, backendName: string): void {\n  const key = makeKey(kernelName,
backendName);\n  if (!kernelRegistry.has(key)) {\n    throw new Error(\n      `The kernel '${kernelName}' for
backend ` +\n      ` '${backendName}' is not registered`);\n  }\n  kernelRegistry.delete(key);\n}\n\n/** Removes the
registered gradient from the global registry. *\nexport function unregisterGradient(kernelName: string): void {\n
if (!gradRegistry.has(kernelName)) {\n  throw new Error(\n    `The gradient '${kernelName}' for backend is not
registered`);\n  }\n  gradRegistry.delete(kernelName);\n}\n\n/**\n * Finds kernels that have already been registered
to a backend and re-registers\n * them for a new backend. Useful for registering custom backends.\n * @param
registeredBackendName Already registered backend.\n * @param newBackendName New backend.\n *\nexport
function copyRegisteredKernels(\n  registeredBackendName: string, newBackendName: string): void {\n  const
kernels = getKernelsForBackend(registeredBackendName);\n  kernels.forEach(kernelConfig => {\n    const
newKernelConfig =\n      Object.assign({}, kernelConfig, {backendName: newBackendName});\n    registerKernel(newKernelConfig);\n  });\n}\n\nfunction makeKey(kernelName: string, backendName: string) {\n
return `${backendName}_${kernelName}`;\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file

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string}>,\n  extraInfo: Promise<string>)\n};\n\nexport class Profiler {\n  constructor(private backendTimer: BackendTimer, private logger?: Logger) {\n    if (logger == null) {\n      this.logger = new Logger();\n    }\n  }\n\n  profileKernel(kernelName: string, inputs: NamedTensorMap, f: () => Tensor[]):\n    KernelProfile {\n      let outputs: Tensor[];\n      const holdResultWrapperFn = () => {\n        outputs = f();\n      };\n      let timer: Promise<BackendTimingInfo>;\n      const start = util.now();\n      if (this.backendTimer.timerAvailable()) {\n        timer = this.backendTimer.time(holdResultWrapperFn);\n      } else {\n        holdResultWrapperFn();\n      }\n      outputs.map(output => output.dataSync());\n      timer = Promise.resolve({kernelMs: util.now() - start});\n    }\n    if (env().getBool('CHECK_COMPUTATION_FOR_ERRORS')) {\n      for (let i = 0; i < outputs.length; i++) {\n        const output = outputs[i];\n        // Dangling promise here because we don't want to propagate up\n        // asynchronicity.\n        output.data().then(tensorVals => {\n          checkComputationForErrors(tensorVals, output.dtype, kernelName);\n        });\n      }\n    }\n    const kernelProfile = {\n      kernelName,\n      outputs,\n      inputs,\n      timeMs: timer.then(timing => timing.kernelMs),\n      extraInfo: timer.then(\n        timing => timing.getExtraProfileInfo != null ?\n          timing.getExtraProfileInfo() :\n          "")\n    };\n    return kernelProfile;\n  }\n\n  logKernelProfile(kernelProfile: KernelProfile): void {\n    const {kernelName, outputs, timeMs, inputs, extraInfo} = kernelProfile;\n    outputs.forEach(result => {\n      Promise.all([result.data(), timeMs, extraInfo]).then(valueContainer => {\n        this.logger.logKernelProfile(\n          kernelName, result, valueContainer[0], valueContainer[1], inputs,\n          valueContainer[2]);\n      });\n    });\n  }\n\n  export function checkComputationForErrors<D extends DataType>(\n    vals: DataTypeMap[D], dtype: D, kernelName: string): boolean {\n    if (dtype !== 'float32') {\n      // Only floating point computations will generate NaN values\n      return false;\n    }\n    for (let i = 0; i < vals.length; i++) {\n      const num = vals[i] as number;\n      if (isNaN(num) || !isFinite(num)) {\n        // Throwing custom exception so behavior is testable.\n        console.warn(`Found ${num} in the result of '${kernelName}'`);\n        return true;\n      }\n    }\n    return false;\n  }\n\n  export class Logger {\n    logKernelProfile(\n      name: string, result: Tensor, vals: TypedArray,\n      timeMs: number | {error: string}, inputs: NamedTensorMap,\n      extraInfo?: string) {\n      const time = typeof timeMs === 'number' ?\n        util.rightPad(`${timeMs}ms`, 9) :\n        timeMs['error'];\n      const paddedName = util.rightPad(name, 25);\n      const rank = result.rank;\n      const size = result.size;\n      const shape = util.rightPad(result.shape.toString(), 14);\n      let inputShapesDescription = "";\n      for (const name in inputs) {\n        const input = inputs[name];\n        if (input != null) {\n          // The input might be a non-tensor (e.g HTMLImageElement), in which case\n          // we claim the output shape as input shape.\n          const inputShape = input.shape || result.shape;\n          const inputRank = inputShape.length;\n          inputShapesDescription +=\n            `${name}: ${inputRank}D ${inputRank > 0 ? inputShape : ""}`;\n        }\n      }\n      console.log(\n        `%c${paddedName} \\t%c${time} \\t%c${rank}D ${shape} \\t%c${size} \\t%c${\n          inputShapesDescription} \\t%c${extraInfo}`,\n        'font-weight:bold', 'color:red', 'color:blue', 'color: orange',\n        'color: green', 'color: steelblue');\n    }\n  }\n\n  /**\n   * @license\n   * Copyright 2017 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n  =====\n\n  *^*\n  import {Tensor} from './tensor';\n  import {NamedTensorMap} from './tensor_types';\n  import * as util from './util';\n\n  export interface TapeNode {\n    id: number;\n    kernelName: string;\n    outputs: Tensor[];\n    inputs: NamedTensorMap;\n    // Optional params, defined only for ops with gradient impl.\n    gradient?: (dys: Tensor[]) => NamedGradientMap;\n    saved?: Tensor[];\n  }\n\n  export type NamedGradientMap = {\n    [inputName: string]: () => Tensor;\n  };\n\n  /**\n   * Computes a list of TapeNodes that connect x to y, filtering everything else\n   * out and preserving the order of the original tape elements.\n   * @param tape The tape elements to filter.\n   * @param xs The input Tensors.\n   * @param y The output Tensor.\n   *^*\n  export function getFilteredNodesXTToY(\n    tape:

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TapeNode[], xs: Tensor[], y: Tensor): TapeNode[] {\n // Forward pass to compute all the nodes and Tensors that are
transitively a\n // function of x.\n const tensorsFromX: {[tensorId: number]: boolean} = {};\n const nodesFromX:
{[nodeId: number]: boolean} = {};\n for (let i = 0; i < xs.length; i++) {\n tensorsFromX[xs[i].id] = true;\n }\n\n for (let i = 0; i < tape.length; i++) {\n const node = tape[i];\n const nodeInputs = node.inputs;\n for (const
inputName in nodeInputs) {\n const input = nodeInputs[inputName];\n let anyInputFromX = false;\n for
(let j = 0; j < xs.length; j++) {\n if (tensorsFromX[input.id]) {\n node.outputs.forEach(output =>
tensorsFromX[output.id] = true);\n anyInputFromX = true;\n nodesFromX[node.id] = true;\n
break;\n }\n }\n\n if (anyInputFromX) {\n break;\n }\n }\n\n // Backward pass to find all of
the nodes and Tensors that lead to y.\n const tensorsLeadToY: {[tensorId: number]: boolean} = {};\n
tensorsLeadToY[y.id] = true;\n const nodesToY: {[nodeId: number]: boolean} = {};\n\n for (let i = tape.length - 1;
i >= 0; i--) {\n const node = tape[i];\n const nodeInputs = node.inputs;\n\n // If any of the outputs lead to y,
mark all of the inputs as leading to y.\n for (let j = 0; j < node.outputs.length; j++) {\n if
(tensorsLeadToY[node.outputs[j].id]) {\n for (const inputName in nodeInputs) {\n
tensorsLeadToY[nodeInputs[inputName].id] = true;\n nodesToY[node.id] = true;\n }\n break;\n
}\n }\n\n // Return the paths that come from x and lead to y.\n const filteredTape: TapeNode[] = [];\n for (let
i = 0; i < tape.length; i++) {\n const node = tape[i];\n\n if (nodesFromX[node.id] && nodesToY[node.id]) {\n
// Prune the inputs from the node that aren't a function of x.\n const prunedInputs: {[inputName: string]: Tensor}
= {};\n for (const inputName in node.inputs) {\n const nodeInput = node.inputs[inputName];\n if
(tensorsFromX[nodeInput.id]) {\n prunedInputs[inputName] = nodeInput;\n }\n }\n\n // Copy the
node and overwrite inputsAndArgs to the pruned version.\n const prunedNode = Object.assign({}, node);\n
prunedNode.inputs = prunedInputs;\n prunedNode.outputs = node.outputs;\n\n filteredTape.push(prunedNode);\n }\n }\n\n return filteredTape;\n }\n\n/**\n * Backpropagate gradients through
the filtered TapeNodes.\n *\n * @param tensorAccumulatedGradientMap A map of Tensor to its gradient. This
map\n * is mutated by this method.\n *\n * @param filteredTape The filtered TapeNodes to backprop through.\n
*\n */\n export function backpropagateGradients(\n tensorAccumulatedGradientMap: {[tensorId: number]: Tensor},\n
filteredTape: TapeNode[], tidy: (f: Function) => Tensor,\n add: (a: Tensor, b: Tensor) => Tensor) {\n // Walk the
tape backward and keep a map of Tensor to its gradient.\n for (let i = filteredTape.length - 1; i >= 0; i--) {\n const
node = filteredTape[i];\n\n const dys: Tensor[] = [];\n node.outputs.forEach(o => {\n const gradTensor =
tensorAccumulatedGradientMap[o.id];\n if (gradTensor != null) {\n dys.push(gradTensor);\n } else {\n
// This particular output is not in the back-propagation subgraph, so it\n // does not affect the final output, thus
we put null for its dy.\n dys.push(null);\n }\n });\n\n if (node.gradient == null) {\n throw new Error(\n
`Cannot compute gradient: gradient function not found` +\n `for ${node.kernelName}.`);\n }\n\n //
Backprop dy through this node and accumulate gradients over the inputs.\n const inputGradients =
node.gradient(dys);\n\n for (const inputName in node.inputs) {\n if (!(inputName in inputGradients)) {\n
throw new Error(\n `Cannot backprop through input ${inputName}.` +\n `Available gradients found:
${Object.keys(inputGradients)}.`);\n }\n\n // Call the gradient function.\n const dx = tidy(() =>
inputGradients[inputName]());\n if (dx.dtype !== 'float32') {\n throw new Error(\n `Error in gradient
for op ${\n node.kernelName}. The gradient of input ` +\n ` ${inputName} must have 'float32'
dtype, but has '${dx.dtype}'`);\n }\n\n const x = node.inputs[inputName];\n if (!util.arraysEqual(dx.shape,
x.shape)) {\n throw new Error(\n `Error in gradient for op ${\n node.kernelName}. The gradient
of input ` +\n ` '${inputName}' has shape '${dx.shape}', which does not match ` +\n ` the shape of the
input '${x.shape}'`);\n }\n\n if (tensorAccumulatedGradientMap[x.id] == null) {\n
tensorAccumulatedGradientMap[x.id] = dx;\n } else {\n const curGradient =
tensorAccumulatedGradientMap[x.id];\n tensorAccumulatedGradientMap[x.id] = add(curGradient, dx);\n
curGradient.dispose();\n }\n }\n }\n }\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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/* isLast */);\n } \n lines.push(...);\n for (let i = size - FORMAT_NUM_FIRST_LAST_VALS; i < size; i++)
{\n   const start = i * stride;\n   const end = start + stride;\n   lines.push(...subTensorToString(\n
vals.slice(start, end), subshape, dtype, strides, padPerCol,\n       i === size - 1 /* isLast */));\n } \n } else {\n
for (let i = 0; i < size; i++) {\n   const start = i * stride;\n   const end = start + stride;\n
lines.push(...subTensorToString(\n       vals.slice(start, end), subshape, dtype, strides, padPerCol,\n       i ===
size - 1 /* isLast */));\n } \n } \n const sep = rank === 2 ? ',': ',';\n lines[0] = '[' + lines[0] + sep;\n for (let i = 1; i <
lines.length - 1; i++) {\n   lines[i] = ' ' + lines[i] + sep;\n } \n let newLineSep = '\\n';\n for (let i = 2; i < rank; i++)
{\n   newLineSep += '\\n';\n } \n lines[lines.length - 1] = ' ' + lines[lines.length - 1] + ']' + (isLast ? '' :
newLineSep);\n return lines;\n }\n\nfunction createComplexTuples(vals: Array<{}> \n
TypedArray): Array<[number, number]> {\n   const complexTuples: Array<[number, number]> = [];\n   for (let i = 0;
i < vals.length; i += 2) {\n     complexTuples.push([vals[i], vals[i + 1]] as [number, number]);\n   } \n   return
complexTuples;\n }\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport {getGlobal} from './global_util';\nimport {tensorToString} from './tensor_format';\nimport {ArrayMap,
BackendValues, DataTypeMap, DataValues, NumericDataType, Rank, ShapeMap, SingleValueMap,
TypedArray} from './types';\nimport * as util from './util';\nimport {computeStrides, toNestedArray} from
'./util';\n\nexport interface TensorData<D extends DataType> {\n   dataId?: DataId;\n   values?:
DataTypeMap[D];\n }\n\n// This interface mimics KernelBackend (in backend.ts), which would create a\n// circular
dependency if imported.\n\nexport interface Backend {} \n\n/**\n * A mutable object, similar to `tf.Tensor`, that
allows users to set values\n * at locations before converting to an immutable `tf.Tensor`. \n * \n * See `tf.buffer` for
creating a tensor buffer.\n * \n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n\nexport class TensorBuffer<R
extends Rank, D extends DataType = 'float32'> {\n   size: number;\n   shape: ShapeMap[R];\n   strides: number[];\n
values: DataTypeMap[D];\n\n   constructor(shape: ShapeMap[R], public dtype: D, values?: DataTypeMap[D]) {\n
this.shape = shape.slice() as ShapeMap[R];\n   this.size = util.sizeFromShape(shape);\n\n   if (values != null) {\n
const n = values.length;\n   util.assert(\n       n === this.size,\n       () => `Length of values '${n}' does not
match the size ` +\n       `inferred by the shape '${this.shape}'.`);\n   } \n   if (dtype === 'complex64') {\n   throw
new Error(\n       `complex64 dtype TensorBuffers are not supported. Please create ` +\n       `a TensorBuffer for
the real and imaginary parts separately and ` +\n       `call tf.complex(real, imag).`);\n   } \n   this.values = values ||
util.getArrayFromDType(dtype, this.size);\n   this.strides = computeStrides(shape);\n } \n\n /**\n * Sets a value in
the buffer at a given location.\n * \n * @param value The value to set.\n * @param locs The location indices.\n
*\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n   set(value: SingleValueMap[D], ...locs: number[]):
void {\n   if (locs.length === 0) {\n     locs = [0];\n   } \n   util.assert(\n       locs.length === this.rank,\n       () =>
`The number of provided coordinates (${locs.length}) must ` +\n       `match the rank (${this.rank})`);\n\n   const
index = this.locToIndex(locs);\n   this.values[index] = value as number;\n } \n\n /**\n * Returns the value in the
buffer at the provided location.\n * \n * @param locs The location indices.\n * \n * @doc {heading: 'Tensors',
subheading: 'Creation'}\n */\n   get(...locs: number[]): SingleValueMap[D] {\n   if (locs.length === 0) {\n     locs =
[0];\n   } \n   let i = 0;\n   for (const loc of locs) {\n     if (loc < 0 || loc >= this.shape[i]) {\n       const msg =
`Requested out of range element at ${locs}. ` +\n       ` Buffer shape=${this.shape}`;\n       throw new
Error(msg);\n     } \n     i++;\n   } \n   let index = locs[locs.length - 1];\n   for (let i = 0; i < locs.length - 1; ++i) {\n
index += this.strides[i] * locs[i];\n   } \n   return this.values[index] as SingleValueMap[D];\n } \n\n
locToIndex(locs: number[]): number {\n   if (this.rank === 0) {\n     return 0;\n   } else if (this.rank === 1) {\n
return locs[0];\n   } \n   let index = locs[locs.length - 1];\n   for (let i = 0; i < locs.length - 1; ++i) {\n     index +=

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this.strides[i] * locs[i];\n  }\n  return index;\n }\n\n indexToLoc(index: number): number[] {\n  if (this.rank ===
0) {\n    return [];\n  } else if (this.rank === 1) {\n    return [index];\n  }\n  const locs: number[] = new
Array(this.shape.length);\n  for (let i = 0; i < locs.length - 1; ++i) {\n    locs[i] = Math.floor(index /
this.strides[i]);\n    index -= locs[i] * this.strides[i];\n  }\n  locs[locs.length - 1] = index;\n  return locs;\n }\n\n get rank() {\n  return this.shape.length;\n }\n\n /**\n * Creates an immutable `tf.Tensor` object from the buffer.\n
*\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n * ^\n toTensor(): Tensor<R> {\n  return
trackerFn().makeTensor(this.values, this.shape, this.dtype) as\n    Tensor<R>;\n }\n\n\nexport interface
TensorTracker {\n  makeTensor(\n    values: DataValues, shape: number[], dtype: DataType,\n    backend?:
Backend): Tensor;\n  makeVariable(\n    initialValue: Tensor, trainable?: boolean, name?: string,\n    dtype?:
DataType): Variable;\n  incRef(a: Tensor, backend: Backend): void;\n  disposeTensor(t: Tensor): void;\n
disposeVariable(v: Variable): void;\n  read(dataId: DataId): Promise<BackendValues>;\n  readSync(dataId: DataId):
BackendValues;\n }\n\n\n/**\n * The Tensor class calls into this handler to delegate chaining operations.\n
* ^\n\nexport
interface OpHandler {\n  cast<T extends Tensor>(x: T, dtype: DataType): T;\n  buffer<R extends Rank, D extends
DataType>(\n    shape: ShapeMap[R], dtype: D,\n    values?: DataTypeMap[D]): TensorBuffer<R, D>;\n  print<T
extends Tensor>(x: T, verbose: boolean): void;\n  clone<T extends Tensor>(x: T): T;\n  // TODO(yassogba) bring
reshape back?\n }\n\n\n// For tracking tensor creation and disposal.\nlet trackerFn: () => TensorTracker = null;\n\n//
Used by chaining methods to call into ops.\nlet opHandler: OpHandler = null;\n\n// Used to warn about deprecated
methods.\nlet deprecationWarningFn: (msg: string) => void = null;\n\n// This here so that we can use this method on
dev branches and keep the\n// functionality at master.\n\n// tslint:disable-next-line:no-unused-
expression\n[deprecationWarningFn];\n\n\n/**\n * An external consumer can register itself as the tensor tracker. This
way\n * the Tensor class can notify the tracker for every tensor created and\n * disposed.\n * ^\n\nexport function
setTensorTracker(fn: () => TensorTracker) {\n  trackerFn = fn;\n }\n\n\n/**\n * An external consumer can register
itself as the op handler. This way the\n * Tensor class can have chaining methods that call into ops via the op\n *
handler.\n * ^\n\nexport function setOpHandler(handler: OpHandler) {\n  opHandler = handler;\n }\n\n\n/**\n * Sets the
deprecation warning function to be used by this file. This way the\n * Tensor class can be a leaf but still use the
environment.\n * ^\n\nexport function setDeprecationWarningFn(fn: (msg: string) => void) {\n  deprecationWarningFn
= fn;\n }\n\n\n/**\n * We wrap data id since we use weak map to avoid memory leaks.\n * Since we have our own
memory management, we have a reference counter\n * mapping a tensor to its data, so there is always a pointer
(even if that\n * data is otherwise garbage collectable).\n * See https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global\_Objects/WeakMap\n * ^\n\nexport type DataId = object; // object
instead of {} to force non-primitive.\n\n\n// Declare this namespace to make Tensor class augmentation work in
google3.\n\nexport declare namespace Tensor {\n\n  /**\n * A `tf.Tensor` object represents an immutable,
multidimensional array of\n * numbers that has a shape and a data type.\n * ^\n * See `tf.tensor` for details on how to
create a `tf.Tensor`.\n * ^\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n * ^\n\nexport class Tensor<R extends
Rank = Rank> {\n  /** Unique id of this tensor. *\n  readonly id: number;\n  /**\n * Id of the bucket holding the
data for this tensor. Multiple arrays can\n * point to the same bucket (e.g. when calling array.reshape()).\n * ^\n
dataId: DataId;\n  /** The shape of the tensor. *\n  readonly shape: ShapeMap[R];\n  /**\n * Number of elements in the
tensor. *\n  readonly size: number;\n  /** The data type for the array. *\n  readonly dtype: DataType;\n  /** The
rank type for the array (see `Rank` enum). *\n  readonly rankType: R;\n\n  /**\n * Whether this tensor has been
globally kept. *\n  kept = false;\n  /** The id of the scope this tensor is being tracked in. *\n  scopeId: number;\n\n
/**\n * Number of elements to skip in each dimension when indexing. See\n *
https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.strides.html\n * ^\n  readonly strides:
number[];\n\n  constructor(shape: ShapeMap[R], dtype: DataType, dataId: DataId, id: number) {\n    this.shape =
shape.slice() as ShapeMap[R];\n    this.dtype = dtype || 'float32';\n    this.size = util.sizeFromShape(shape);\n
this.strides = computeStrides(shape);\n    this.dataId = dataId;\n    this.id = id;\n    this.rankType = (this.rank < 5 ?
this.rank.toString() : 'higher') as R;\n  }\n\n  get rank(): number {\n    return this.shape.length;\n  }\n\n  /**\n *
Returns a promise of `tf.TensorBuffer` that holds the underlying data.\n * ^\n * @doc {heading: 'Tensors',
subheading: 'Classes'}\n * ^\n  async buffer<D extends DataType = 'float32'>(): Promise<TensorBuffer<R, D>> {\n

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const vals = await this.data<D>();\n  return opHandler.buffer(this.shape, this.dtype as D, vals);\n }\n\n /**\n * Returns a `tf.TensorBuffer` that holds the underlying data.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n bufferSync<D extends DataType = 'float32'>(): TensorBuffer<R, D> {\n  return opHandler.buffer(this.shape,\n    this.dtype as D, this.dataSync());\n }\n\n /**\n * Returns the tensor data as a nested array. The transfer of data is\n    done\n * asynchronously.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n async array():\n  Promise<ArrayMap[R]> {\n    const vals = await this.data();\n    return toNestedArray(this.shape, vals) as\n      ArrayMap[R];\n  }\n\n /**\n * Returns the tensor data as a nested array. The transfer of data is done\n * synchronously.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n arraySync(): ArrayMap[R] {\n  return toNestedArray(this.shape, this.dataSync()) as ArrayMap[R];\n }\n\n /**\n * Asynchronously downloads the\n    values from the `tf.Tensor`. Returns a\n * promise of `TypedArray` that resolves when the computation has\n    finished.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n async data<D extends DataType =\n  NumericDataType>(): Promise<DataTypeMap[D]> {\n  this.throwIfDisposed();\n  const data =\n    trackerFn().read(this.dataId);\n  if (this.dtype === 'string') {\n    const bytes = await data as Uint8Array[];\n    try\n    {\n      return bytes.map(b => util.decodeString(b)) as DataTypeMap[D];\n    } catch {\n      throw new Error(\n        'Failed to decode the string bytes into utf-8. '\n        +\n        'To get the original bytes, call tensor.bytes().');\n    }\n  }\n  return data as Promise<DataTypeMap[D]>;\n }\n\n /**\n * Synchronously downloads the values from the\n    `tf.Tensor`. This blocks the\n * UI thread until the values are ready, which can cause performance issues.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n dataSync<D extends DataType = NumericDataType>():\n  DataTypeMap[D] {\n  this.throwIfDisposed();\n  const data = trackerFn().readSync(this.dataId);\n  if (this.dtype\n    === 'string') {\n    try {\n      return (data as Uint8Array[]).map(b => util.decodeString(b)) as\n        DataTypeMap[D];\n    } catch {\n      throw new Error(\n        'Failed to decode the string bytes into utf-8. '\n        +\n        'To get the original bytes, call tensor.bytes().');\n    }\n  }\n  return data as DataTypeMap[D];\n }\n\n /**\n Returns the underlying bytes of the tensor's data.\n */\n async bytes(): Promise<Uint8Array[]|Uint8Array> {\n  this.throwIfDisposed();\n  const data = await trackerFn().read(this.dataId);\n  if (this.dtype === 'string') {\n    return data as Uint8Array[];\n  } else {\n    return new Uint8Array((data as TypedArray).buffer);\n  }\n }\n\n /**\n * Disposes `tf.Tensor` from memory.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n dispose(): void {\n  if (this.isDisposed) {\n    return;\n  }\n  trackerFn().disposeTensor(this);\n  this.isDisposedInternal = true;\n }\n\n protected isDisposedInternal = false;\n get isDisposed(): boolean {\n  return this.isDisposedInternal;\n }\n\n throwIfDisposed() {\n  if (this.isDisposed) {\n    throw new Error(`Tensor\n    is disposed.`);\n  }\n }\n\n /**\n * Prints the `tf.Tensor`. See `tf.print` for details.\n * @param verbose\n    Whether to print verbose information about the tensor,\n * including dtype and size.\n * @doc {heading:\n    'Tensors', subheading: 'Classes'}\n */\n print(verbose = false): void {\n  return opHandler.print(this, verbose);\n }\n\n /**\n * Returns a copy of the tensor. See `tf.clone` for details.\n * @doc {heading: 'Tensors', subheading:\n    'Classes'}\n */\n clone<T extends Tensor>(this: T): T {\n  this.throwIfDisposed();\n  return\n    opHandler.clone(this);\n }\n\n /**\n * Returns a human-readable description of the tensor. Useful for logging.\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n toString(verbose = false): string {\n  const vals =\n    this.dataSync();\n  return tensorToString(vals, this.shape, this.dtype, verbose);\n }\n\n cast<T extends this>(dtype:\n  DataType): T {\n  this.throwIfDisposed();\n  return opHandler.cast(this as T, dtype);\n }\n\n variable(trainable =\n  true, name?: string, dtype?: DataType): Variable<R> {\n  this.throwIfDisposed();\n  return\n    trackerFn().makeVariable(this, trainable, name, dtype) as\n      Variable<R>;\n }\n\n }\n\n Object.defineProperty(Tensor, Symbol.hasInstance, {\n  value: (instance: Tensor) => {\n    // Implementation\n    note: we should use properties of the object that will be\n    // defined before the constructor body has finished\n    executing (methods).\n    // This is because when this code is transpiled by babel, babel will call\n    //\n    classCallCheck before the constructor body is run.\n    // See https://github.com/tensorflow/tfjs/issues/3384 for\n    backstory.\n    return !!instance && instance.data !== null && instance.dataSync !== null &&\n      instance.throwIfDisposed !== null;\n  }\n});\n\n export function getGlobalTensorClass() {\n  // Use getGlobal so that\n    we can augment the Tensor class across package\n // boundaries because the node resolution alg may result in\n    different modules\n // being returned for this file depending on the path they are loaded from.\n  return

```



```
walkTensorContainer(\n  container: TensorContainer, list: Tensor[], seen: Set<{}|void>): void {\n  if (container ==\n  null) {\n    return;\n  }\n  if (container instanceof Tensor) {\n    list.push(container);\n    return;\n  }\n  if\n  (!Iterable(container)) {\n    return;\n  }\n  // Iteration over keys works also for arrays.\n  const iterable = container\n  as TensorContainerArray;\n  for (const k in iterable) {\n    const val = iterable[k];\n    if (!seen.has(val)) {\n      seen.add(val);\n      walkTensorContainer(val, list, seen);\n    }\n  }\n}\n\n// tslint:disable-next-line:no-any\nfunction\n  isIterable(obj: any): boolean {\n  return Array.isArray(obj) || typeof obj === 'object';\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {BackendTimingInfo, DataMover, KernelBackend} from './backends/backend';\nimport {Environment,\n  setEnvironmentGlobal} from './environment';\nimport {getGlobalNamespace} from './global_util';\nimport {Add,\n  Cast, Identity} from './kernel_names';\nimport {getGradient, getKernel, getKernelsForBackend, GradFunc,\n  NamedAttrMap, TensorInfo} from './kernel_registry';\nimport {KernelProfile, Profiler} from './profiler';\nimport\n  {backpropagateGradients, getFilteredNodesXToY, TapeNode} from './tape';\nimport {DataId, setTensorTracker,\n  Tensor, TensorTracker, Variable} from './tensor';\nimport {GradSaveFunc, NamedTensorMap, NamedVariableMap,\n  TensorContainer} from './tensor_types';\nimport {getTensorsInContainer} from './tensor_util';\nimport\n  {BackendValues, DataType, DataValues} from './types';\nimport * as util from './util';\nimport\n  {bytesFromStringArray, makeOnesTypedArray, now, sizeFromShape} from './util';\n\n/**\n * A function that\n * computes an output. The save function is for saving tensors\n * computed in the forward pass, that we need in the\n * backward pass.\n */\nexport type ForwardFunc<T> = (backend: KernelBackend, save?: GradSaveFunc) =>\n  T;\n\n/**\n * @docalias (a: Tensor, b: Tensor, ..., save?: Function) => {\n *   value: Tensor,\n *   gradFunc: (dy:\n *   Tensor, saved?: NamedTensorMap) => Tensor | Tensor[]\n * }\n */\nexport type CustomGradientFunc<T extends\n  Tensor> = (\n  ...inputs: Array<Tensor|GradSaveFunc>) => {\n  value: T;\n  gradFunc: (dy: T, saved:\n  Tensor[]) => Tensor | Tensor[];\n  };\n\nexport type MemoryInfo = {\n  numTensors: number;\n  numDataBuffers:\n  number;\n  numBytes: number;\n  unreliable?: boolean;\n  reasons: string[];\n};\n\nexport type KernelInfo = {\n  name: string;\n  bytesAdded: number;\n  totalBytesSnapshot: number;\n  tensorsAdded: number;\n  totalTensorsSnapshot: number;\n  inputShapes: number[][];\n  outputShapes: number[][];\n  kernelTimeMs: number | {error: string} |  
  Promise<number|{error: string}>;\n  extraInfo: string | Promise<string>;\n};\n\nexport type ProfileInfo = {\n  newBytes: number;\n  newTensors: number;\n  peakBytes: number;\n  kernels: KernelInfo[];\n  result:\n  TensorContainer;\n  kernelNames: string[];\n};\n\nexport interface TimingInfo extends BackendTimingInfo {\n  wallMs: number;\n}\n\n/**\n * @docalias Function\n */\nexport type ScopeFn<T extends TensorContainer> = () =>\n  T;\n\ninterface ScopeState {\n  track: Tensor[];\n  name: string;\n  id: number;\n}\n\ninterface\n  RegisteredKernelInvocation<I extends NamedTensorMap> {\n  kernelName: string;\n  inputs: I;\n  attrs?:\n  NamedAttrMap;\n}\n\ninterface CustomGradKernelInvocation<T extends Tensor|Tensor[],\n  I extends NamedTensorMap> {\n  forwardFunc: ForwardFunc<T>;\n  backwardsFunc: (dy: T, saved: Tensor[])\n  => {\n    [P in keyof I]: () => I[P]\n  }; \n  inputs: I;\n  attrs?: NamedAttrMap;\n}\n\nfunction\n  isRegisteredKernelInvocation<T extends Tensor|Tensor[],\n  I extends NamedTensorMap>(\n    kernelInvocation: RegisteredKernelInvocation<I>|\n    CustomGradKernelInvocation<T,\n    I>):\n    kernelInvocation is RegisteredKernelInvocation<I> {\n  return (kernelInvocation as\n  RegisteredKernelInvocation<I>).kernelName != null;\n}\n\nexport class EngineState {\n  // Public since optimizers will\n  use it.\n  registeredVariables: NamedVariableMap = {};\n  nextTapeNodeId = 0;\n  numBytes = 0;\n  numTensors\n  = 0;\n  numStringTensors = 0;\n  numDataBuffers = 0;\n  activeTape: TapeNode[];\n  // Number of nested tf.grad(\n  statements when computing higher-order\n  // gradients. E.g. `1` for first-order gradients and `2` for second-order\n  // gradients. Used to track if the tape should be removed after a backprop.\n  gradientDepth = 0;\n  // Number of
```

```

nested kernel calls. When kernel depth is greater than 1, we turn
// off the tape.
kernelDepth = 0;
// Keep
Tensors that parallel the tapes.
activeScope: ScopeState;
scopeStack: ScopeState[] = [];
/**
 * Keeps track
of the number of data moves during a kernel execution. We
 * maintain a stack since kernels can call other
kernels, recursively.
 */
numDataMovesStack: number[] = [];
nextScopeId = 0;
tensorInfo = new
WeakMap<DataId, {
  backend: KernelBackend,
  bytes: number,
  dtype: DataType,
  shape: number[]
}>();
profiling = false;
activeProfile: ProfileInfo = {
  newBytes: 0,
  newTensors: 0,
  peakBytes: 0,
  kernels: [],
  result: null,
  get kernelNames():
    string[] {
    return Array.from(new
Set(this.kernels.map(k => k.name)));
  }
};
dispose() {
  for (const variableName in
this.registeredVariables) {
    this.registeredVariables[variableName].dispose();
  }
}
export class
Engine implements TensorTracker, DataMover {
  state: EngineState;
  backendName: string;
  registry: {[id:
string]: KernelBackend} = {};
  registryFactory: {
    [id: string]: {
      factory: () => KernelBackend |
Promise<KernelBackend>,
      priority: number
    }
  } = {};
  private profiler: Profiler;
  private
backendInstance: KernelBackend;
  private pendingBackendInit: Promise<boolean>;
  private
pendingBackendInitId = 0;
  constructor(public ENV: Environment) {
    this.state = new EngineState();
  }
  async ready(): Promise<void> {
    if (this.pendingBackendInit != null) {
      return
this.pendingBackendInit.then(() => {});
    }
    if (this.backendInstance != null) {
      return;
    }
    const
sortedBackends = this.getSortedBackends();
    for (let i = 0; i < sortedBackends.length; i++) {
      const
backendName = sortedBackends[i];
      const success = await this.initializeBackend(backendName).success;
      if (success) {
        await this.setBackend(backendName);
        return;
      }
      throw new Error(
`Could not initialize any backends, all backend initializations
` +
`failed.`);
    }
    get backend():
KernelBackend {
      if (this.pendingBackendInit != null) {
        throw new Error(
`Backend
'${this.backendName}' has not yet been initialized. Make
` +
`sure to await tf.ready() or await
tf.setBackend() before calling
` +
`other methods`);
      }
      if (this.backendInstance == null) {
        const
{name, asyncInit} = this.initializeBackendsAndReturnBest();
        if (asyncInit) {
          throw new Error(
`The highest priority backend '${name}' has not yet been
` +
`initialized. Make sure to await tf.ready() or
` +
`await tf.setBackend() before calling other methods`);
        }
        this.setBackend(name);
      }
      return
this.backendInstance;
    }
    backendNames(): string[] {
      return Object.keys(this.registryFactory);
    }
    findBackend(backendName: string): KernelBackend {
      if (!(backendName in this.registry)) {
        // If the
backend hasn't been initialized but we have a registry entry for
        // it, initialize it and return it.
        if
(backendName in this.registryFactory) {
          const {asyncInit} = this.initializeBackend(backendName);
          if
(asyncInit) {
            // Backend is not ready yet.
            return null;
          }
        } else {
          return null;
        }
      }
      return this.registry[backendName];
    }
    findBackendFactory(backendName: string):
KernelBackend | Promise<KernelBackend> {
      if (!(backendName in this.registryFactory)) {
        return null;
      }
      return this.registryFactory[backendName].factory;
    }
    registerBackend(
backendName: string,
factory: () => KernelBackend | Promise<KernelBackend>,
priority = 1): boolean {
      if (backendName in
this.registryFactory) {
        console.warn(
`${backendName} backend was already registered.
` +
`Reusing existing backend factory.`);
        return false;
      }
      this.registryFactory[backendName] = {
        factory,
        priority
      };
      return true;
    }
    async setBackend(backendName: string): Promise<boolean> {
      if
(this.registryFactory[backendName] == null) {
        throw new Error(
`Backend name '${backendName}' not found
in registry`);
      }
      this.backendName = backendName;
      if (this.registry[backendName] == null) {
        this.backendInstance = null;
        const {success, asyncInit} = this.initializeBackend(backendName);
        const
result = asyncInit ? await success : success;
        if (!result) {
          return false;
        }
      }
      this.backendInstance = this.registry[backendName];
      this.setupRegisteredKernels();
      // Reset the profiler.
      this.profiler = new Profiler(this.backendInstance);
      return true;
    }
    private setupRegisteredKernels(): void {
      const kernels = getKernelsForBackend(this.backendName);
      kernels.forEach(kernel => {
        if
(kernel.setupFunc != null) {
          kernel.setupFunc(this.backendInstance);
        }
      });
    }
    private
disposeRegisteredKernels(backendName: string): void {
      const kernels =
getKernelsForBackend(backendName);
      kernels.forEach(kernel => {
        if (kernel.disposeFunc != null) {

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kernel.disposeFunc(this.registry[backendName]);\n    }\n    });\n    }\n\n    /**\n     * Initializes a backend by looking
up the backend name in the factory\n     * registry and calling the factory method. Returns a boolean representing\n     * whether the initialization of the backend succeeded. Throws an error if\n     * there is no backend in the factory
registry.\n     */\n    private initializeBackend(backendName: string):\n        {success: boolean|Promise<boolean>,\n        asyncInit: boolean} {\n        const registryFactoryEntry = this.registryFactory[backendName];\n        if
(registryFactoryEntry == null) {\n            throw new Error(\n                `Cannot initialize backend ${backendName}, no
registration found.`);\n        }\n        try {\n            const backend = registryFactoryEntry.factory();\n            /* Test if the
factory returns a promise.\n            Done in a more liberal way than\n            previous
'Promise.resolve(backend)===backend'\n            as we needed to account for custom Promise\n            implementations
(e.g. Angular) */\n            if (backend && !(backend instanceof KernelBackend) &&\n                typeof backend.then ===
'function') {\n                const promiseId = ++this.pendingBackendInitId;\n                const success =\n                    backend\n                    .then(backendInstance => {\n
                        // Outdated promise. Another backend was set in the meantime.\n
                        if (promiseId < this.pendingBackendInitId) {\n
                            return false;\n
                        }\n
                        this.registry[backendName] = backendInstance;\n
                        this.pendingBackendInit = null;\n
                        return
true;\n
                    })\n                    .catch(err => {\n
                        // Outdated promise. Another backend was set in the
meantime.\n
                        if (promiseId < this.pendingBackendInitId) {\n
                            return false;\n
                        }\n
                        this.pendingBackendInit = null;\n
                        console.warn(\n
                            `Initialization of backend
${backendName} failed`);\n
                        console.warn(err.stack || err.message);\n
                        return false;\n
                    });\n                this.pendingBackendInit = success;\n                return {success, asyncInit: true};\n            } else {\n
this.registry[backendName] = backend as KernelBackend;\n                return {success: true, asyncInit: false};\n            }\n        }
catch (err) {\n            console.warn(`Initialization of backend ${backendName} failed`);\n            console.warn(err.stack ||
err.message);\n            return {success: false, asyncInit: false};\n        }\n    }\n\n    removeBackend(backendName: string):
void {\n        if (!(backendName in this.registryFactory)) {\n            throw new Error(`${backendName} backend not found
in registry`);\n        }\n        if (this.backendName === backendName && this.pendingBackendInit != null) {\n            //
There is a pending promise of the backend we want to remove. Make it\n            // obsolete.\n            this.pendingBackendInitId++;\n        }\n        if (backendName in this.registry) {\n
this.disposeRegisteredKernels(backendName);\n            this.registry[backendName].dispose();\n            delete
this.registry[backendName];\n        }\n        delete this.registryFactory[backendName];\n        // Unset the backend if it is
active.\n        if (this.backendName === backendName) {\n            this.pendingBackendInit = null;\n            this.backendName
= null;\n            this.backendInstance = null;\n        }\n    }\n\n    private getSortedBackends(): string[] {\n        if
(Object.keys(this.registryFactory).length === 0) {\n            throw new Error('No backend found in registry.);\n        }\n        return Object.keys(this.registryFactory).sort((a: string, b: string) => {\n
// Highest priority comes first.\n            return
this.registryFactory[b].priority -\n                this.registryFactory[a].priority;\n        });\n    }\n\n    private
initializeBackendsAndReturnBest():\n        {name: string, asyncInit: boolean} {\n        const sortedBackends =
this.getSortedBackends();\n        for (let i = 0; i < sortedBackends.length; i++) {\n            const backendName =
sortedBackends[i];\n            const {success, asyncInit} = this.initializeBackend(backendName);\n            if (asyncInit ||
success) {\n                return {name: backendName, asyncInit};\n            }\n        }\n        throw new Error(\n            `Could not
initialize any backends, all backend initializations ` +\n            `failed.`);\n    }\n\n    moveData(backend: KernelBackend,\n        dataId: DataId) {\n        const info = this.state.tensorInfo.get(dataId);\n        const srcBackend = info.backend;\n        const
values = this.readSync(dataId);\n        const refCount = srcBackend.refCount(dataId);\n        // Delete the tensor from the
old backend and move it to the new\n        // backend.\n        srcBackend.disposeData(dataId, true);\n        info.backend =
backend;\n        backend.move(dataId, values, info.shape, info.dtype, refCount);\n        if
(this.shouldCheckForMemLeaks()) {\n            // Track the number of moves during a kernel execution to correctly\n
// detect memory leaks.\n            this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1]++; \n        }\n    }\n\n    tidy<T extends TensorContainer>(nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>):\n        T {\n        let name:
string = null;\n        if (fn == null) {\n            // Called with only 1 argument.\n            if (typeof nameOrFn !== 'function') {\n
                throw new Error('Please provide a function to tidy());\n            }\n            fn = nameOrFn;\n        } else {\n            // Called with
2 arguments.\n            if (typeof nameOrFn !== 'string' && !(nameOrFn instanceof String)) {\n                throw new Error(\n

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    'When calling with two arguments, the first argument ' +\n
    'to tidy() must be a string');\n
  }\n
  if (typeof fn !== 'function') {\n
    throw new Error(\n
      'When calling with two arguments, the 2nd argument '\n
      '+\n
      'to tidy() must be a function');\n
    }\n
  name = nameOrFn as string;\n
  // TODO(nsthorat,smilkov):\n
  Do operation logging and performance\n
  // profiling.\n
  }\n
  let result: T;\n
  return this.scopedRun(\n
    ()\n
    => this.startScope(name), () => this.endScope(result), () => {\n
      result = fn();\n
      if (result instanceof\n
      Promise) {\n
        console.error('Cannot return a Promise inside of tidy.);\n
      }\n
      return result;\n
    });\n
  }\n\n
  private scopedRun<T>(start: () => void, end: () => void, f: () => T): T {\n
    start();\n
    try {\n
      const\n
      res = f();\n
      end();\n
      return res;\n
    } catch (ex) {\n
      end();\n
      throw ex;\n
    }\n
  }\n\n
  private static\n
  nextTensorId = 0;\n
  private nextTensorId(): number {\n
    return Engine.nextTensorId++;\n
  }\n\n
  private static\n
  nextVariableId = 0;\n
  private nextVariableId(): number {\n
    return Engine.nextVariableId++;\n
  }\n\n
  /**\n
  * This method is called instead of the public-facing tensor.clone()\n
  * when\n
  * saving a tensor for backwards pass. It\n
  * makes sure to add the clone\n
  * operation to the tape regardless of being called inside a kernel\n
  * execution.\n
  */\n
  private clone(x: Tensor): Tensor {\n
    const y: Tensor = ENGINE.runKernel(Identity, {x} as {\n
    as\n
    NamedTensorMap});\n
    const inputs = {x};\n
    const grad = (dy: Tensor) => ({\n
    x: () => {\n
    const dtype =\n
    'float32';\n
    const gradInputs = {x: dy};\n
    const attrs = {dtype};\n
    return ENGINE.runKernel(\n
    Cast, gradInputs as {\n
    as NamedTensorMap,\n
    // tslint:disable-next-line: no-unnecessary-type-\n
    assertion\n
    attrs as {\n
    as NamedAttrMap} as Tensor;\n
    }\n
    });\n
    const saved: Tensor[] = [];\n
    this.addTapeNode(this.state.activeScope.name, inputs, [y], grad, saved, {});\n
    return y;\n
  }\n\n
  /**\n
  * Execute\n
  * a kernel with the given name and return the output tensor.\n
  * @param kernelName The name of the kernel to\n
  * execute.\n
  * @param inputs A map of input names to tensors.\n
  * @param attrs A map of attribute names to their\n
  * values. An attribute is a\n
  * primitive (non-tensor) input to the kernel.\n
  * @param inputsToSave A list of\n
  * tensors, inputs to save for the backprop\n
  * computation.\n
  * @param outputsToSave A list of booleans,\n
  * specifying which output to save\n
  * for the backprop computation. These are booleans since the output\n
  * tensors are not visible to the user.\n
  */\n
  runKernel<T extends Tensor|Tensor[]>(\n
    kernelName: string, inputs:\n
    NamedTensorMap, attrs?: NamedAttrMap): T {\n
    const hasKernel = getKernel(kernelName, this.backendName)\n
    != null;\n
    if (!hasKernel) {\n
      throw new Error(`Kernel '${kernelName}' not registered for backend\n
    '${\n
    this.backendName}'`);\n
    }\n
    return this.runKernelFunc({kernelName, inputs, attrs});\n
  }\n\n
  private\n
  shouldCheckForMemLeaks(): boolean {\n
    return this.ENV.getBool('IS_TEST');\n
  }\n\n
  private\n
  checkKernelForMemLeak(\n
    kernelName: string, numDataIdsBefore: number,\n
    outInfos: TensorInfo[]): void\n
  {\n
    const numDataIdsAfter = this.backend.numDataIds();\n
    // Count the number of data ids associated with the\n
    result of the kernel.\n
    let numOutputDataIds = 0;\n
    outInfos.forEach(info => {\n
      // Complex numbers allocate\n
      3 data ids, one for 'real', one for\n
      // 'imaginary', and one for the container that holds the former two.\n
      numOutputDataIds += (info.dtype === 'complex64' ? 3 : 1);\n
    });\n
    // Account for the number of moves during\n
    kernel execution. A "data move"\n
    // can happen in the middle of a kernel execution, placing a new (key,value)\n
    // pair in the data storage. Since data moves have net zero effect (we\n
    // always remove the data from the old\n
    backend), we have to cancel them out\n
    // when detecting memory leaks.\n
    const numMoves =\n
    this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1];\n
    const dataIdsLeaked =\n
    numDataIdsAfter - numDataIdsBefore - numOutputDataIds - numMoves;\n
    if (dataIdsLeaked > 0) {\n
      throw\n
      new Error(\n
        `Backend '${this.backendName}' has an internal memory leak ` +\n
        `+\n
        `(${dataIdsLeaked}\n
        data ids) after running '${kernelName}'`);\n
    }\n
  }\n\n
  /**\n
  * Internal helper method to execute a kernel Func\n
  * @param Use `runKernel` to execute kernels from outside of engine.\n
  */\n
  private runKernelFunc<T extends\n
  Tensor|Tensor[], I extends NamedTensorMap>(\n
    kernelParams: RegisteredKernelInvocation<I>)\n
  CustomGradKernelInvocation<T, I>): T {\n
    let outputs: Tensor[];\n
    let saved: Tensor[] = [];\n
    const isTapeOn\n
    = this.isTapeOn();\n
    const startingBytecount = this.state.numBytes;\n
    const startingNumTensors =\n
    this.state.numTensors;\n
    if (this.shouldCheckForMemLeaks()) {\n
      this.state.numDataMovesStack.push(0);\n
    }\n
    let kernelFunc: () => Tensor[];\n
    if (this.backendName == null) {\n
      // backend has not been initialized\n
      yet (backend initialization is lazy\n
      // can be deferred until an op/ kernel is run).\n
      // The below getter has side\n
      effects that will try to initialize the\n
      // backend and set properties like this.backendName\n
      // tslint:disable-

```

```

next-line: no-unused-expression\n    this.backend;\n    }\n\n    let out: TensorInfo|TensorInfo[];\n\n    const
kernelOrScopeName = isRegisteredKernelInvocation(kernelParams) ?\n        kernelParams.kernelName :\nthis.state.activeScope != null ? this.state.activeScope.name : '';\n\n    // Create the kernelFunc from either a registered
kernel OR passed in\n    // forward/backward functions (used by custom grad). In this context a\n    // kernelFunc
wraps a kernel implementation with some bookkeeping.\n\n    if (isRegisteredKernelInvocation(kernelParams)) {\n
const {kernelName, inputs, attrs} = kernelParams;\n    if (this.backendName == null) {\n        // backend has not
been initialized yet (backend initialization is lazy\n        // can be deferred until an op/ kernel is run).\n        // The
below getter has side effects that will try to initialize the\n        // backend and set properties like
this.backendName\n        // tslint:disable-next-line: no-unused-expression\n        this.backend;\n    }\n    const
kernel = getKernel(kernelName, this.backendName);\n    util.assert(\n        kernel != null,\n        () => `Cannot
find registered kernel '${kernelName}' for backend '${\n            this.backendName}`);\n\n    kernelFunc = () =>
{\n        const numDataIdsBefore = this.backend.numDataIds();\n        out = kernel.kernelFunc({inputs, attrs,
backend: this.backend});\n        const outInfos = Array.isArray(out) ? out : [out];\n        if
(this.shouldCheckForMemLeaks()) {\n            this.checkKernelForMemLeak(kernelName, numDataIdsBefore,
outInfos);\n        }\n        const outTensors = outInfos.map((outInfo: TensorInfo|Tensor) => {\n            // todo
(yassogba) remove this option (Tensor) when node backend\n            // methods have been modularized and they all
return tensorInfo.\n            // TensorInfos do not have a rank attribute.\n            if ((outInfo as Tensor).rank != null) {\n
return outInfo as Tensor;\n            }\n            const {dataId, shape, dtype} = outInfo as TensorInfo;\n            return
this.makeTensorFromDataId(dataId, shape, dtype);\n        });\n\n        // Save any required inputs and outputs.\n\n
// Do not save unless we are recording to the tape. Otherwise it would\n        // cause a mem leak since there would
be no backprop for these tensors\n        // (which would otherwise dispose them).\n        if (isTapeOn) {\n            const
tensorsToSave =\n                this.getTensorsForGradient(kernelName, inputs, outTensors);\n            saved =
this.saveTensorsForBackwardMode(tensorsToSave);\n        }\n        return outTensors;\n    }; \n    } else {\n
const {forwardFunc} = kernelParams;\n    // Running a customGrad op.\n    const saveFunc: GradSaveFunc =
(tensors) => {\n        // Do not save unless we are recording to the tape. Otherwise it would\n        // cause a mem
leak since we would never run backprop, which disposes\n        // the kept tensors.\n        if (!isTapeOn) {\n
return;\n        }\n        saved = tensors.map(tensor => this.keep(this.clone(tensor)));\n    }; \n\n    kernelFunc = () =>
{\n        const numDataIdsBefore = this.backend.numDataIds();\n        out = this.tidy(() =>
forwardFunc(this.backend, saveFunc));\n        const outs = (Array.isArray(out) ? out : [out]) as Tensor[];\n        if
(this.shouldCheckForMemLeaks()) {\n            // Scope name is used to print a more helpful error message if
needed.\n            this.checkKernelForMemLeak(kernelOrScopeName, numDataIdsBefore, outs);\n        }\n        return
outs;\n    }; \n    }\n\n    // Run the kernelFunc. Optionally profiling it.\n    // const {inputs, attrs} =
kernelParams;\n    const backwardsFunc = isRegisteredKernelInvocation(kernelParams) ?\n        null :\nkernelParams.backwardsFunc;\n\n    let kernelProfile: KernelProfile;\n    this.scopedRun(\n        // Stop recording to
a tape when running a kernel.\n        () => this.state.kernelDepth++, () => this.state.kernelDepth--, () => {\n            if
(!this.ENV.getBool('DEBUG') && !this.state.profiling) {\n                outputs = kernelFunc();\n            } else {\n
kernelProfile = this.profiler.profileKernel(\n                kernelOrScopeName, inputs, () => kernelFunc());\n            if
(this.ENV.getBool('DEBUG')) {\n                this.profiler.logKernelProfile(kernelProfile);\n            }\n            outputs
= kernelProfile.outputs;\n        });\n\n        if (isTapeOn) {\n            this.addTapeNode(\n
kernelOrScopeName, inputs, outputs, backwardsFunc, saved, attrs);\n        }\n\n        if (this.state.profiling) {\n
this.state.activeProfile.kernels.push({\n            name: kernelOrScopeName,\n            bytesAdded: this.state.numBytes -
startingBytecount,\n            totalBytesSnapshot: this.state.numBytes,\n            tensorsAdded: this.state.numTensors -
startingNumTensors,\n            totalTensorsSnapshot: this.state.numTensors,\n            inputShapes:
Object.keys(inputs).map(\n                key => inputs[key] != null ? inputs[key].shape : null),\n            outputShapes:
outputs.map(item => item.shape),\n            kernelTimeMs: kernelProfile.timeMs,\n            extraInfo:
kernelProfile.extraInfo\n        });\n    }\n\n    return (Array.isArray(out) ? outputs : outputs[0]) as T;\n    }\n\n    /**\n     *
Saves tensors used in forward mode for use in backward mode.\n     * @param tensors the list of tensors to
save.\n     */\n    private saveTensorsForBackwardMode(tensors: Tensor[]): Tensor[] {\n        const saved =

```

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tensors.map(tensor => this.keep(this.clone(tensor)));
return saved;
}

/**
 * Returns a list of tensors to
save for a given gradient calculation.
 * @param kernelName name of kernel to look up gradient for.
 * @param inputs a map of input tensors.
 * @param outputs an array of output tensors from forward mode of
kernel.
 */
private getTensorsForGradient(
    kernelName: string, inputs: NamedTensorMap,
    outputs:
Tensor[]): Tensor[] {
    const gradConfig = getGradient(kernelName);
    if (gradConfig != null) {
        const
inputsToSave: string[] = gradConfig.inputsToSave || [];
        const outputsToSave: boolean[] =
gradConfig.outputsToSave || [];
        // If saveAllInputs is true, all inputs will be saved. Otherwise, inputs
//
specified in inputsToSave will be saved.
        let inputTensorsToSave: Tensor[];
        if (gradConfig.saveAllInputs) {
            util.assert(
                Array.isArray(inputs),
                () => 'saveAllInputs is true, expected inputs to be an
array.');
```

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            inputTensorsToSave = Object.keys(inputs).map((key) => inputs[key]);
        } else {
            inputTensorsToSave = inputsToSave.map((inputName) => inputs[inputName]);
        }
        const
outputTensorsToSave: Tensor[] =
        outputs.filter((_, i) => outputsToSave[i]);
        return
inputTensorsToSave.concat(outputTensorsToSave);
    }
    // We return an empty list rather than throw an error
because the kernel we
    // are looking up may not actually be relevant to backpropping through the
    // overall
function
    // See 'does not error if irrelevant (pruned) ops are missing grads' test
    // in gradients_test.ts
for an example.
return [];
}

/**
 * Internal method used by public APIs for tensor creation. Makes a new
 * tensor with the provided shape, dtype and values. It always
 * creates a new data id and writes the values to the
underlying backend.
 */
makeTensor(
    values: DataValues, shape: number[], dtype: DataType,
backend?: KernelBackend): Tensor {
    if (values == null) {
        throw new Error('Values passed to
engine.makeTensor() are null');
```

```

    }
    dtype = dtype || 'float32';
    backend = backend || this.backend;
    let
backendVals = values as BackendValues;
    if (dtype === 'string' && util.isString(values[0])) {
        backendVals
= (values as string[]).map(d => util.encodeString(d));
    }
    const dataId = backend.write(backendVals, shape,
dtype);
    const t = new Tensor(shape, dtype, dataId, this.nextTensorId());
    this.trackTensor(t, backend);
    //
Count bytes for string tensors.
    if (dtype === 'string') {
        const info = this.state.tensorInfo.get(dataId);
        const newBytes = bytesFromStringArray(backendVals as Uint8Array[]);
        this.state.numBytes += newBytes -
info.bytes;
        info.bytes = newBytes;
    }
    return t;
}

/**
 * Internal method used by backends.
Makes a new tensor
 * that is a wrapper around an existing data id. It doesn't create
 * a new data id, only
increments the ref count used in memory tracking.
 */
makeTensorFromDataId(
    dataId: DataId, shape:
number[], dtype: DataType,
backend?: KernelBackend): Tensor {
    dtype = dtype || 'float32';
    const t =
new Tensor(shape, dtype, dataId, this.nextTensorId());
    this.trackTensor(t, backend);
    return t;
}

makeVariable(
    initialValue: Tensor, trainable = true, name?: string,
dtype?: DataType): Variable {
    name = name || this.nextVariableId().toString();
    if (dtype != null && dtype !== initialValue.dtype) {
        initialValue = initialValue.cast(dtype);
    }
    const v = new Variable(initialValue, trainable, name,
this.nextTensorId());
    if (this.state.registeredVariables[v.name] != null) {
        throw new Error(`Variable with
name ${v.name} was already registered`);
    }
    this.state.registeredVariables[v.name] = v;
    this.incRef(v,
this.backend);
    return v;
}

trackTensor(a: Tensor, backend: KernelBackend): void {
    this.state.numTensors++;
    if (a.dtype === 'string') {
        this.state.numStringTensors++;
    }
    // Bytes for
complex numbers are counted by their components. Bytes for
    // string tensors are counted when writing
values.
    let bytes = 0;
    if (a.dtype !== 'complex64' && a.dtype !== 'string') {
        bytes = a.size *
util.bytesPerElement(a.dtype);
    }
    this.state.numBytes += bytes;
    if (!this.state.tensorInfo.has(a.dataId)) {
        this.state.numDataBuffers++;
        this.state.tensorInfo.set(a.dataId, {
            backend: backend ||
this.backend,
            dtype: a.dtype,
            shape: a.shape,
            bytes
        });
    }
    if (!(a instanceof
Variable)) {
        this.track(a);
    }
}

// Track the tensor by dataId and increase the refCount for the dataId in
the
// backend.
// TODO(pyu10055): This is currently used by makeVariable method, to increase
// refCount
on the backend for the dataId. It can potentially be replaced with
// Identity op in dead of calling backend
directly.
incRef(a: Tensor, backend: KernelBackend): void {
    this.trackTensor(a, backend);
    this.backend.incRef(a.dataId);
}

removeDataId(dataId: DataId, backend: KernelBackend) {
    if
(this.state.tensorInfo.has(dataId) &&
        this.state.tensorInfo.get(dataId).backend === backend) {

```

```

this.state.tensorInfo.delete(dataId);\n    this.state.numDataBuffers--;\n    }\n }\n disposeTensor(a: Tensor): void
{\n if (!this.state.tensorInfo.has(a.dataId)) {\n return;\n }\n const info =
this.state.tensorInfo.get(a.dataId);\n\n this.state.numTensors--;\n if (a.dtype === 'string') {\n
this.state.numStringTensors--;\n    this.state.numBytes -= info.bytes;\n    }\n // Don't count bytes for complex
numbers as they are counted by their\n // components.\n if (a.dtype !== 'complex64' && a.dtype !== 'string') {\n
const bytes = a.size * util.bytesPerElement(a.dtype);\n    this.state.numBytes -= bytes;\n    }\n\n // Remove the
reference to dataId if backend dispose the data successfully\n if (info.backend.disposeData(a.dataId)) {\n
this.removeDataId(a.dataId, info.backend);\n    }\n\n // TODO(nsthorat): Construct an error and save the stack
trace for\n // debugging when in debug mode. Creating a stack trace is too expensive\n // to do unconditionally.\n
}\n\n disposeVariables(): void {\n for (const varName in this.state.registeredVariables) {\n const v =
this.state.registeredVariables[varName];\n    this.disposeVariable(v);\n    }\n }\n\n disposeVariable(v: Variable):
void {\n this.disposeTensor(v);\n if (this.state.registeredVariables[v.name] != null) {\n delete
this.state.registeredVariables[v.name];\n    }\n }\n\n memory(): MemoryInfo {\n const info =
this.backend.memory() as MemoryInfo;\n    info.numTensors = this.state.numTensors;\n    info.numDataBuffers =
this.state.numDataBuffers;\n    info.numBytes = this.state.numBytes;\n    if (this.state.numStringTensors > 0) {\n
info.unreliable = true;\n    if (info.reasons == null) {\n        info.reasons = [];\n    }\n    info.reasons.push(\n
'Memory usage by string tensors is approximate ' +\n        '(2 bytes per character)');\n    }\n    return info;\n }\n\n
async profile(query: () => (TensorContainer | Promise<TensorContainer>)): Promise<ProfileInfo> {\n
this.state.profiling = true;\n\n const startBytes = this.state.numBytes;\n const startNumTensors =
this.state.numTensors;\n\n this.state.activeProfile.kernels = [];\n this.state.activeProfile.result = await
query();\n\n this.state.profiling = false;\n\n this.state.activeProfile.peakBytes = Math.max(\n
...this.state.activeProfile.kernels.map(d => d.totalBytesSnapshot));\n this.state.activeProfile.newBytes =
this.state.numBytes - startBytes;\n this.state.activeProfile.newTensors =\n    this.state.numTensors -
startNumTensors;\n for (const kernel of this.state.activeProfile.kernels) {\n    kernel.kernelTimeMs = await
kernel.kernelTimeMs;\n    kernel.extraInfo = await kernel.extraInfo;\n    }\n return this.state.activeProfile;\n
}\n\n isTapeOn(): boolean {\n return this.state.gradientDepth > 0 && this.state.kernelDepth === 0;\n }\n\n
private addTapeNode(\n    kernelName: string, inputs: NamedTensorMap, outputs: Tensor[],\n    gradientsFunc:
GradFunc, saved: Tensor[], attrs: NamedAttrMap): void {\n    const tapeNode: TapeNode =\n        {id:
this.state.nextTapeNodeId++, kernelName, inputs, outputs, saved};\n\n    const gradConfig =
getGradient(kernelName);\n    if (gradConfig != null) {\n        gradientsFunc = gradConfig.gradFunc;\n    }\n    if
(gradadientsFunc != null) {\n        tapeNode.gradient = (dys: Tensor[]) => {\n            // TODO(smilkov): To optimize
back-prop, pass dys that are not used in\n            // the backprop graph to the user as null instead of zeros\n            dys =
dys.map((dy, i) => {\n                if (dy == null) {\n                    const output = outputs[i];\n                    const vals =
util.makeZerosTypedArray(output.size, output.dtype);\n                    return this.makeTensor(vals, output.shape,
output.dtype);\n                }\n                return dy;\n            });\n            // Grad functions of ops with single outputs expect a dy,
while ops\n            // with multiple outputs expect dys (array of dy).\n            return gradientsFunc(dys.length > 1 ? dys :
dys[0], saved, attrs);\n        }; \n    }\n    this.state.activeTape.push(tapeNode);\n }\n\n keep<T extends
Tensor>(result: T): T {\n    result.kept = true;\n    return result;\n }\n\n private startTape() {\n    if
(this.state.gradientDepth === 0) {\n        this.state.activeTape = [];\n    }\n    this.state.gradientDepth++;\n }\n\n
private endTape() {\n    this.state.gradientDepth--;\n }\n\n /**\n * Start a scope. Use this with endScope() to
achieve the same functionality\n * as scope() without the need for a function closure.\n */\n startScope(name?:
string) {\n    const scopeInfo: ScopeState = {\n        track: [],\n        name: 'unnamed scope',\n        id:
this.state.nextScopeId++\n    }; \n    if (name) {\n        scopeInfo.name = name;\n    }\n    this.state.scopeStack.push(scopeInfo);\n    this.state.activeScope = scopeInfo;\n }\n\n /**\n * End a scope. Use
this with startScope() to achieve the same functionality\n * as scope() without the need for a function closure.\n
*/\n endScope(result?: TensorContainer) {\n    const tensorsToTrackInParent = getTensorsInContainer(result);\n    const tensorsToTrackInParentSet =\n        new Set(tensorsToTrackInParent.map(t => t.id));\n\n // Dispose the
arrays tracked in this scope.\n    for (let i = 0; i < this.state.activeScope.track.length; i++) {\n        const tensor =

```



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this.state.activeScope.track[i];\n    if (!tensor.kept && !tensorsToTrackInParentSet.has(tensor.id)) {\n
tensor.dispose();\n    }\n    }\n\n    const oldScope = this.state.scopeStack.pop();\n    this.state.activeScope =\n    this.state.scopeStack.length === 0 ?\n    null :\n    this.state.scopeStack[this.state.scopeStack.length - 1];\n\n    //\n    Track the current result in the parent scope.\n    tensorsToTrackInParent.forEach(tensor => {\n    // Only track the\n    tensor if was allocated in the inner scope and is not\n    // globally kept.\n    if (!tensor.kept && tensor.scopeId\n    === oldScope.id) {\n    this.track(tensor);\n    }\n    });\n    }\n\n    /**\n    * Returns gradients of `f` with respect to\n    each of the `xs`. The gradients\n    * returned are of the same length as `xs`, but some might be null if `f`\n    * was\n    not a function of that `x`. It also takes optional dy to multiply the\n    * gradient, which defaults to `1`.\n    */\n    gradients<T extends Tensor>(\n    f: () => T, xs: Tensor[], dy?: T,\n    allowNoGradients = false): {value: T,\n    grads: Tensor[]} {\n    util.assert(\n    xs.length > 0, () => 'gradients() received an empty list of xs.);\n    if (dy !=\n    null && dy.dtype !== 'float32') {\n    throw new Error(`dy must have 'float32' dtype, but has '${dy.dtype}');\n    }\n\n    const y = this.scopedRun(\n    () => this.startTape(), () => this.endTape(),\n    () => this.tidy('forward',\n    f));\n\n    util.assert(\n    y instanceof Tensor,\n    () => 'The result y returned by f() must be a tensor.);\n    //\n    Filter out the nodes that don't connect x => y.\n    const filteredTape = getFilteredNodesXToY(this.state.activeTape,\n    xs, y);\n    if (!allowNoGradients && filteredTape.length === 0 && xs.length > 0) {\n    throw new Error(\n    'Cannot compute gradient of y=f(x) with respect to x. Make sure '\n    +\n    'that the f you passed encloses all\n    operations that lead from x '\n    +\n    'to y.);\n    }\n\n    return this.tidy('backward', () => {\n    const\n    accumulatedGradientMap: {[tensorId: number]: Tensor} = {};\n    accumulatedGradientMap[y.id] = (dy == null) ?\n    ones(y.shape) : dy;\n\n    // Backprop gradients through the filtered nodes.\n    backpropagateGradients(\n    accumulatedGradientMap, filteredTape,\n    // Pass the tidy function to avoid circular dep with `tape.ts`.\n    f\n    => this.tidy(f as ScopeFn<Tensor>),\n    // Pass an add function to avoid a circular dep with `tape.ts`.\n    add);\n    const grads = xs.map(x => accumulatedGradientMap[x.id]);\n\n    if (this.state.gradientDepth === 0) {\n    // This means that we are not computing higher-order gradients\n    // and can clean up the tape.\n    this.state.activeTape.forEach(node => {\n    for (const tensor of node.saved) {\n    tensor.dispose();\n    }\n    });\n    this.state.activeTape = null;\n    }\n\n    return {value: y, grads};\n    });\n    }\n\n    customGrad<T\n    extends Tensor>(f: CustomGradientFunc<T>):\n    (...args: Array<Tensor|GradSaveFunc>) => T {\n    util.assert(\n    util.isFunction(f),\n    () => 'The f passed in customGrad(f) must be a function.);\n    return (...inputs:\n    Tensor[]): T => {\n    util.assert(\n    inputs.every(t => t instanceof Tensor),\n    () => 'The args passed in\n    customGrad(f)(x1, x2,...) must all be '\n    +\n    'tensors');\n\n    let res: {\n    value: T,\n    gradFunc: (dy: T,\n    saved: Tensor[]) => Tensor | Tensor[],\n    };\n    const inputMap: NamedTensorMap = {};\n\n    inputs.forEach((input, i) => {\n    inputMap[i] = input;\n    });\n\n    const forwardFunc: ForwardFunc<T> = (\n    _,\n    save) => {\n    res = f(...inputs, save);\n    util.assert(\n    res.value instanceof Tensor,\n    () =>\n    'The function f passed in customGrad(f) must return an '\n    +\n    'object where `obj.value` is a tensor');\n\n    util.assert(\n    util.isFunction(res.gradFunc),\n    () => 'The function f passed in customGrad(f) must return\n    an '\n    +\n    'object where `obj.gradFunc` is a function.);\n    return res.value;\n    };)\n\n    const\n    backwardsFunc = (dy: T, saved: Tensor[]) => {\n    const gradRes = res.gradFunc(dy, saved);\n    const grads:\n    Tensor[] = Array.isArray(gradRes) ? gradRes : [gradRes];\n    util.assert(\n    grads.length ===\n    inputs.length,\n    () => 'The function f passed in customGrad(f) must return an '\n    +\n    'object where\n    `obj.gradFunc` is a function that returns '\n    +\n    'the same number of tensors as inputs passed to f(...).);\n\n    util.assert(\n    grads.every(t => t instanceof Tensor),\n    () => 'The function f passed in customGrad(f)\n    must return an '\n    +\n    'object where `obj.gradFunc` is a function that returns '\n    +\n    'a list of only\n    tensors.);\n\n    const gradMap: {[key: string]: () => Tensor} = {};\n    grads.forEach((grad, i) => {\n    gradMap[i] = () => grad;\n    });\n\n    return gradMap;\n    });\n\n    return this.runKernelFunc({\n    forwardFunc,\n    backwardsFunc,\n    inputs: inputMap,\n    });\n    }\n\n    readSync(dataId: DataId):\n    BackendValues {\n    // Route the read to the correct backend.\n    const info = this.state.tensorInfo.get(dataId);\n    return info.backend.readSync(dataId);\n    }\n\n    read(dataId: DataId): Promise<BackendValues> {\n    // Route the read\n    to the correct backend.\n    const info = this.state.tensorInfo.get(dataId);\n    return info.backend.read(dataId);\n    }\n\n    async time(query: () => void): Promise<TimingInfo> {\n    const start = now();\n    const timingInfo = await

```



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)|qtek|r380|r600|raks|rim9|ro(ve|zo)|s55|\\|sa(ge|ma|mm|ms|ny|va)|sc(01|h|-|oo|p|-)|sdk|\\|se(c|-
|0|1)|47|mc|nd|ri)|sgh|-|shar|sie(\\|-|m)|sk|-0|sl(45|id)|sm(al|ar|b3|it|t5)|so(ft|ny)|sp(01|h|-|v|-|v
)|sy(01|mb)|t2(18|50)|t6(00|10|18)|ta(gt|lk)|tcl|-|tdg|-|tel(i|m)|tim|-|t|-|mo|to(pl|sh)|ts(70|m|-|m3|m5)|tx|-
9|up(\\.|b|g|l|si)|utst|v400|v750|veri|vi(rg|te)|vk(40|5[0-3])|-
v)|vm40|voda|vulc|vx(52|53|60|61|70|80|81|83|85|98)|w3c(\\|-| )|webc|whit|wi(g|nc|nw)|wmlb|wonu|x700|yas|-
|your|zeto|zte|-/i|n      .test(a.substr(0, 4));\n } \n return false;\n }\n\nexport function isBrowser(): boolean {\n
return (typeof window !== 'undefined' && window.document !== null) ||\n // @ts-ignore\n (typeof
WorkerGlobalScope !== 'undefined');\n }\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\nimport './engine';\nimport * as device_util from './device_util';\nimport {env} from './environment';\nconst
ENV = env();\n\n/**\n * This file contains environment-related flag registrations.\n *\n/** Whether to enable
debug mode. *\nENV.registerFlag('DEBUG', () => false, debugValue => {\n if (debugValue) {\n
console.warn(\n   'Debugging mode is ON. The output of every math call will '+\n   'be downloaded to CPU
and checked for NaNs. '+\n   'This significantly impacts performance.);\n } \n});\n\n/** Whether we are in a
browser (as versus, say, node.js) environment. *\nENV.registerFlag('IS_BROWSER', () =>
device_util.isBrowser());\n\n/** Whether we are in a browser (as versus, say, node.js) environment.
*\nENV.registerFlag(\n  'IS_NODE',\n  () => (typeof process !== 'undefined') &&\n  (typeof process.versions
!== 'undefined') &&\n  (typeof process.versions.node !== 'undefined'));\n\n/** Whether this browser is Chrome.
*\nENV.registerFlag(\n  'IS_CHROME',\n  () => typeof navigator !== 'undefined' && navigator !== null &&\n
navigator.userAgent !== null && /Chrome/.test(navigator.userAgent) &&\n  /Google
Inc/.test(navigator.vendor));\n\n/**\n * True when the environment is "production" where we disable safety
checks\n * to gain performance.\n *\nENV.registerFlag('PROD', () => false);\n\n/**\n * Whether to do sanity
checks when inferring a shape from user-provided\n * values, used when creating a new tensor.\n
*\nENV.registerFlag(\n  'TENSORLIKE_CHECK_SHAPE_CONSISTENCY', () =>
ENV.getBool('DEBUG'));\n\n/** Whether deprecation warnings are enabled.
*\nENV.registerFlag('DEPRECATION_WARNINGS_ENABLED', () => true);\n\n/** True if running unit tests.
*\nENV.registerFlag('IS_TEST', () => false);\n\n/** Whether to check computation result for errors.
*\nENV.registerFlag('CHECK_COMPUTATION_FOR_ERRORS', () => true);\n\n", "/*\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {ENGINE} from './engine';\nimport {env} from './environment';\nimport {Tensor} from
 './tensor';\nimport {DataType, TensorLike} from './types';\nimport {assert, flatten, inferDtype, isTypedArray,
toTypedArray} from './util';\n\nexport function inferShape(val: TensorLike, dtype?: DataType): number[] {\n
let firstElem: typeof val = val;\n if (isTypedArray(val)) {\n   return dtype === 'string' ? [] : [val.length];\n } \n
if (!Array.isArray(val)) {\n   return []; // Scalar.\n } \n const shape: number[] = [];\n\n while
(Array.isArray(firstElem) ||\n   isTypedArray(firstElem) && dtype !== 'string') {\n

```



```

opName.substring(0, opName.length - 1);\n } \n\n // add an __op suffix to distinguish ops from kernels in
tf.profile\n opName = opName + OP_SCOPE_SUFFIX;\n\n // tslint:disable-next-line:no-any\n const f2 = (...args:
any[]) => {\n  ENGINE.startScope(opName);\n  try {\n    const result = fn(...args);\n    if (isPromise(result)) {\n
      console.error('Cannot return a Promise inside of tidy.);\n    }\n    ENGINE.endScope(result);\n    return
result;\n  } catch (ex) {\n    ENGINE.endScope(null);\n    throw ex;\n  }\n }; \n Object.defineProperty(f2,
'name', {value: opName, configurable: true});\n\n // tslint:disable-next-line:no-any\n return f2 as any as
T;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

===== \n
*\nimport {ENGINE} from './engine';\nimport {Complex, ComplexInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from
 './operation';\n\n/**\n * Converts two real numbers to a complex number.\n * Given a tensor `real` representing
the real part of a complex number, and a\n * tensor `imag` representing the imaginary part of a complex number,
this\n * operation returns complex numbers elementwise of the form [r0, i0, r1, i1],\n * where r represents the real
part and i represents the imag part.\n * The input tensors real and imag must have the same shape.\n * ````js\n
* const real = tf.tensor1d([2.25, 3.25]);\n * const imag = tf.tensor1d([4.75, 5.75]);\n * const complex =
tf.complex(real, imag);\n * complex.print();\n * ````\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n
*\nfunction complex_<T extends Tensor>(real: T|TensorLike, imag: T|TensorLike): T {\n  const $real =
convertToTensor(real, 'real', 'complex');\n  const $imag = convertToTensor(imag, 'imag', 'complex');\n
  util.assertShapesMatch(\n    $real.shape, $imag.shape,\n    `real and imag shapes, ${$real.shape} and
${$imag.shape}, ` +\n    `must match in call to tf.complex().`);\n\n  const inputs: ComplexInputs = {real: $real,
imag: $imag};\n  return ENGINE.runKernel(Complex, inputs as { } as NamedTensorMap);\n}\n\nexport const
complex = op({complex_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

===== \n
*\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {TensorLike, TypedArray}
from './types';\nimport {DataType} from './types';\nimport {assert, assertNonNegativeIntegerDimensions, flatten,
inferDtype, isArray, sizeFromShape, toTypedArray} from './util';\n\n/** This is shared code across all tensor
creation methods. *\nexport function makeTensor(\n  values: TensorLike, shape: number[], inferredShape:
number[],\n  dtype?: DataType): Tensor {\n  if (dtype == null) {\n    dtype = inferDtype(values);\n  }\n  if (dtype
=== 'complex64') {\n    throw new Error(\n      `Cannot construct a complex64 tensor directly. ` +\n      `Please use
tf.complex(real, imag).`);\n  }\n  if (!isArray(values) && !Array.isArray(values) &&\n    typeof values !==
'number' && typeof values !== 'boolean' &&\n    typeof values !== 'string') {\n    throw new Error(\n      'values
passed to tensor(values) must be a number/boolean/string or ' +\n      'an array of numbers/booleans/strings, or a
TypedArray');\n  }\n  if (shape != null) {\n    assertNonNegativeIntegerDimensions(shape);\n\n    const providedSize
= sizeFromShape(shape);\n    const inferredSize = sizeFromShape(inferredShape);\n    assert(\n      providedSize
=== inferredSize,\n      `Based on the provided shape, [${shape}], the tensor should have ` +\n      `
${providedSize} values but has ${inferredSize}`);\n\n    for (let i = 0; i < inferredShape.length; ++i) {\n      const

```



```

*\n shape: number[];\n\n /**\n * Data type of the weight.\n */\n dtype:
'float32'|'int32'|'bool'|'string'|'complex64';\n\n /**\n * Type of the weight.\n */\n * Optional.\n */\n * The value
'optimizer' indicates the weight belongs to an optimizer\n * (i.e., used only during model training and not during
inference).\n */\n group?: WeightGroup;\n\n /**\n * Information for dequantization of the weight.\n */\n
quantization?: {\n  scale?: number, // The scaling constant to multiply by.\n  min?: number, // The (possibly
nudged) minimum weight to add.\n  dtype: 'uint16'|'uint8'|'float16' // The dtype of the quantized weights.\n
};\n}\n\n /**\n * Options for saving a model.\n */\n @namespace io\n */\nexport interface SaveConfig {\n /**\n *
Whether to save only the trainable weights of the model, ignoring the\n * non-trainable ones.\n */\n
trainableOnly?: boolean;\n\n /**\n * Whether the optimizer will be saved (if exists).\n */\n * Default: `false`.\n
*/\n includeOptimizer?: boolean;\n}\n\n /**\n * Result of a saving operation.\n */\nexport interface SaveResult {\n
/**\n * Information about the model artifacts saved.\n */\n modelArtifactsInfo: ModelArtifactsInfo;\n\n /**\n *
HTTP responses from the server that handled the model-saving request (if\n * any). This is applicable only to
server-based saving routes.\n */\n responses?: Response[];\n\n /**\n * Error messages and related data (if any).\n
*/\n errors?: Array<{}|string>;\n}\n\nexport declare interface ModelArtifactsInfo {\n /**\n * Timestamp for
when the model is saved.\n */\n dateSaved: Date;\n\n /**\n * TODO(cais,yassogba) consider removing
GraphDef as GraphDefs now\n * come in a JSON format and none of our IOHandlers support a non json\n *
format. We could conder replacing this with 'Binary' if we want to\n * allow future handlers to save to non json
formats (though they will\n * probably want more information than 'Binary').\n */\n * Type of the model topology\n
*/\n * Type of the model topology\n */\n * Possible values:\n * - JSON: JSON config (human-readable, e.g.,
Keras JSON).\n * - GraphDef: TensorFlow\n *
[GraphDef](https://www.tensorflow.org/extend/tool_developers/#graphdef)\n * protocol buffer (binary).\n */\n
modelTopologyType: 'JSON'|'GraphDef';\n\n /**\n * Size of model topology (Keras JSON or GraphDef), in
bytes.\n */\n modelTopologyBytes?: number;\n\n /**\n * Size of weight specification or manifest, in bytes.\n
*/\n weightSpecsBytes?: number;\n\n /**\n * Size of weight value data, in bytes.\n */\n weightDataBytes?:
number;\n}\n\n /**\n * Model training configuration. */\nexport declare interface TrainingConfig {\n // TODO(cais):
Tighten the typing once keras spec is available to tfjs-core.\n // See\n // tslint:disable-next-line:max-line-length\n //
https://github.com/tensorflow/tfjs-layers/blob/master/src/keras_format/training_config.ts\n /**\n * Optimizer used for
the model training. */\n optimizer_config: {};\n\n // TODO(cais): Tighten the typing once keras spec is available to
tfjs-core.\n /**\n * Loss function(s) for the model's output(s). */\n loss: string|string[]|{[key: string]: string};\n\n //
TODO(cais): Tighten the typing once keras spec is available to tfjs-core.\n /**\n * Metric function(s) for the model's
output(s). */\n metrics?: string[]|{[key: string]: string};\n\n // TODO(cais): Tighten the typing once keras spec is
available to tfjs-core.\n weighted_metrics?: string[];\n\n // TODO(cais): Tighten the typing once keras spec is
available to tfjs-core.\n sample_weight_mode?: string;\n\n loss_weights?: number[]|{[key: string]:
number};\n}\n\n /**\n * The serialized artifacts of a model, including topology and weights.\n */\n * The
`modelTopology`, `trainingConfig`, `weightSpecs` and `weightData` fields\n * of this interface are optional, in order
to support topology- or weights-only\n * saving and loading.\n */\n * Note this interface is used internally in
IOHandlers. For the file format\n * written to disk as `model.json`, see `ModelJSON`.\n */\nexport declare interface
ModelArtifacts {\n /**\n * Model topology.\n */\n * For Keras-style `tf.Model`s, this is a JSON object.\n * For
TensorFlow-style models (e.g., `SavedModel`), this is the JSON\n * encoding of the `GraphDef` protocol buffer.\n
*/\n modelTopology?: {}|ArrayBuffer;\n\n /**\n * Serialized configuration for the model's training.\n */\n
trainingConfig?: TrainingConfig;\n\n /**\n * Weight specifications.\n */\n * This corresponds to the
weightsData below.\n */\n weightSpecs?: WeightsManifestEntry[];\n\n /**\n * Binary buffer for all weight
values concatenated in the order specified\n * by `weightSpecs`.\n */\n weightData?: ArrayBuffer;\n\n /**\n *
Hard-coded format name for models saved from TensorFlow.js or converted\n * by TensorFlow.js Converter.\n */\n
format?: string;\n\n /**\n * What library is responsible for originally generating this artifact.\n */\n * Used
for debugging purposes. E.g., 'TensorFlow.js v1.0.0'.\n */\n generatedBy?: string;\n\n /**\n * What library or
tool is responsible for converting the original model\n * to this format, applicable only if the model is output by a
converter.\n */\n * Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'.\n */\n * A value of

```

``null`` means the model artifacts are generated without any conversion process (e.g., saved directly from a TensorFlow.js `tf.LayersModel`` instance.)

`convertedBy?: string|null;`

`/** Inputs and outputs signature for saved model.`

`signature?: { };`

`/** User-defined metadata about the model.`

`userDefinedMetadata?: {[key: string]: { }};`

`/** Initializer for the model.`

`modelInitializer?: { };`

`/** The on-disk format of the `model.json` file.`

`TF.js 1.0` always populates the optional fields when writing `model.json`. Prior versions did not provide those fields.

`export declare interface ModelJSON`

`{`

`modelTopology: { };`

`/** Model topology.`

`For Keras-style `tf.Model`s, this is a JSON object.`

`For TensorFlow-style models (e.g., `SavedModel`), this is the JSON`

`encoding of the `GraphDef` protocol buffer.`

`modelTopology: { };`

`/** Model training configuration.`

`trainingConfig?: TrainingConfig;`

`/** Weights manifest.`

`The weights manifest consists of an ordered list of weight-manifest`

`groups. Each weight-manifest group consists of a number of weight values`

`stored in a number of paths. See the documentation of`

``WeightsManifestConfig` for more details.`

`weightsManifest: WeightsManifestConfig;`

`/** Hard-coded format name for models saved from TensorFlow.js or`

`converted by TensorFlow.js Converter.`

`format?: string;`

`/** What library is responsible for originally generating this artifact.`

`Used for debugging purposes. E.g., `TensorFlow.js v1.0.0`.`

`generatedBy?: string;`

`/** What library or tool is responsible for converting the original model`

`to this format, applicable only if the model is output by a converter.`

`Used for debugging purposes. E.g., `TensorFlow.js Converter v1.0.0`.`

`A value of `null` means the model artifacts are generated without any`

`conversion process (e.g., saved directly from a TensorFlow.js`

`tf.LayersModel` instance.)`

`convertedBy?: string|null;`

`/** Inputs and outputs signature for saved model.`

`signature?: { };`

`/** User-defined metadata about the model.`

`userDefinedMetadata?: {[key: string]: { }};`

`/** Initializer for the model.`

`modelInitializer?: { };`

`/** Type definition for handlers of loading operations.`

`export type LoadHandler = () => Promise<ModelArtifacts>;`

`/** Type definition for handlers of saving operations.`

`export type SaveHandler = (modelArtifact: ModelArtifacts) =>`

`Promise<SaveResult>;`

`/** Interface for a model import/export handler.`

`The `save` and `load` handlers are both optional, in order to allow handlers`

`that support only saving or loading.`

`// tslint:disable-next-line:interface-name`

`export interface IOHandler {`

`save?: SaveHandler;`

`load?: LoadHandler;`

`}`

`/** An interface for the manager of a model store.`

`A model store is defined as a storage medium on which multiple models can`

`be stored. Each stored model has a unique `path` as its identifier.`

`A `ModelStoreManager` for the store allows actions including`

`- Listing the models stored in the store.`

`- Deleting a model from the store.`

`export interface ModelStoreManager {`

`/** List all models in the model store.`

`@returns A dictionary mapping paths of existing models to their`

`model artifacts info. Model artifacts info include type of the model's`

`topology, byte sizes of the topology, weights, etc.`

`listModels(): Promise<{[path: string]: ModelArtifactsInfo}>;`

`/** Remove a model specified by `path`.`

`@param path`

`@returns ModelArtifactsInfo of the deleted model (if and only if deletion`

`is successful).`

`@throws Error if deletion fails, e.g., if no model exists at `path`.`

`removeModel(path: string): Promise<ModelArtifactsInfo>;`

`/** Callback for the progress of a long-running action such as an`

`HTTP`

`request for a large binary object.`

`fraction` should be a number in the [0, 1] interval, indicating`

`how`

`much of the action has completed.`

`export type OnProgressCallback = (fraction: number) =>`

`void;`

`/** @namespace io`

`export interface LoadOptions {`

`/** RequestInit (options) for HTTP requests.`

`For detailed information on the supported fields, see`

`[https://developer.mozilla.org/en-US/docs/Web/API/Request/Request]`

`(`

`https://developer.mozilla.org/en-US/docs/Web/API/Request/Request)`

`requestInit?: RequestInit;`

`/** Progress callback.`

`onProgress?: OnProgressCallback;`

`/** A function used to override the `window.fetch` function.`

`fetchFunc?: Function;`

`/** Strict loading model: whether extraneous weights or missing`

`weights should trigger an `Error`.`

`If `true`, require that the provided weights exactly match those`

`required by the layers. `false` means that both extra weights`

`and missing weights will be silently ignored.`

`Default: `true`.`

`strict?: boolean;`

`/** Path prefix for weight files, by default this is calculated from`

the path of the model JSON file. For instance, if the path to the model JSON file is `http://localhost/foo/model.json`, then the default path prefix will be `http://localhost/foo/`. If a weight file has the path value `group1-shard1of2` in the weight manifest, then the weight file will be loaded from `http://localhost/foo/group1-shard1of2` by default. However, if you provide a `weightPathPrefix` value of `http://localhost/foo/alt-weights`, then the weight file will be loaded from the path `http://localhost/foo/alt-weights/group1-shard1of2` instead.

`weightPathPrefix?: string` Whether the module or model is to be loaded from TF Hub. Setting this to `true` allows passing a TF-Hub module URL, omitting the standard model file name and the query parameters. Default: `false`. `fromTFHub?: boolean`

An async function to convert weight file name to URL. The weight file names are stored in `model.json`'s `weightsManifest.paths` field. By default we consider weight files are colocated with the `model.json` file. For example: `model.json URL: https://www.google.com/models/1/model.json group1-shard1of1.bin url: https://www.google.com/models/1/group1-shard1of1.bin` With this func you can convert the weight file name to any URL.

`weightUrlConverter?: (weightFileName: string) => Promise<string>`

Additional options for `Platform.fetch`

export interface RequestDetails {
`isBinary?: boolean`,
`useStrict`
`nextExports.byteLength = byteLength`
`nextExports.toByteArray = toByteArray`
`nextExports.fromByteArray = fromByteArray`
`lookup = []`
`revLookup = []`
`Arr = typeof Uint8Array !== 'undefined' ? Uint8Array : Array`
`code = 'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/'`
`for (var i = 0, len = code.length; i < len; ++i) {`
`lookup[i] = code[i]`
`revLookup[code.charCodeAt(i)] = i`
 Support decoding URL-safe base64 strings, as Node.js does. See:
https://en.wikipedia.org/wiki/Base64#URL_applications
`revLookup['-'.charCodeAt(0)] = 62`
`revLookup['_'.charCodeAt(0)] = 63`
`function getLens (b64) {`
`var len = b64.length`
`if (len % 4 > 0) {`
`throw new Error('Invalid string. Length must be a multiple of 4')`
`}`
`// Trim off extra bytes after placeholder bytes are found`
`// See: https://github.com/beatgammit/base64-js/issues/42`
`var validLen = b64.indexOf('=)`
`(validLen === -1) validLen = len`
`var placeholdersLen = validLen === len ? 0 : 4 - (validLen % 4)`
`return [validLen, placeholdersLen]`
`}`
`// base64 is 4/3 + up to two characters of the original data`
`function byteLength (b64) {`
`var lens = getLens(b64)`
`var validLen = lens[0]`
`var placeholdersLen = lens[1]`
`return ((validLen + placeholdersLen) * 3 / 4) - placeholdersLen`
`}`
`function _byteLength (b64, validLen, placeholdersLen) {`
`return ((validLen + placeholdersLen) * 3 / 4) - placeholdersLen`
`}`
`function toByteArray (b64) {`
`var tmp`
`var lens = getLens(b64)`
`var validLen = lens[0]`
`var placeholdersLen = lens[1]`
`var arr = new Arr(_byteLength(b64, validLen, placeholdersLen))`
`var curByte = 0`
`// if there are placeholders, only get up to the last complete 4 chars`
`var len = placeholdersLen > 0 ? validLen - 4 : validLen`
`for (var i = 0; i < len; i += 4) {`
`tmp = (revLookup[b64.charCodeAt(i)] << 18) | (revLookup[b64.charCodeAt(i + 1)] << 12) | (revLookup[b64.charCodeAt(i + 2)] << 6) | revLookup[b64.charCodeAt(i + 3)]`
`arr[curByte++] = (tmp >> 16) & 0xFF`
`arr[curByte++] = (tmp >> 8) & 0xFF`
`arr[curByte++] = tmp & 0xFF`
`}`
`if (placeholdersLen === 2) {`
`tmp = (revLookup[b64.charCodeAt(i)] << 2) | (revLookup[b64.charCodeAt(i + 1)] >> 4)`
`arr[curByte++] = tmp & 0xFF`
`}`
`if (placeholdersLen === 1) {`
`tmp = (revLookup[b64.charCodeAt(i)] << 10) | (revLookup[b64.charCodeAt(i + 1)] << 4) | (revLookup[b64.charCodeAt(i + 2)] >> 2)`
`arr[curByte++] = (tmp >> 8) & 0xFF`
`arr[curByte++] = tmp & 0xFF`
`}`
`return arr`
`}`
`function tripletToBase64 (num) {`
`return lookup[num >> 18 & 0x3F] + lookup[num >> 12 & 0x3F] + lookup[num >> 6 & 0x3F] + lookup[num & 0x3F]`
`}`
`function encodeChunk (uint8, start, end) {`
`var tmp`
`var output = []`
`for (var i = start; i < end; i += 3) {`
`tmp = ((uint8[i] << 16) & 0xFF0000) + ((uint8[i + 1] << 8) & 0xFF00) + (uint8[i + 2] & 0xFF)`
`output.push(tripletToBase64(tmp))`
`}`
`return output.join('')`
`}`
`function fromByteArray (uint8) {`
`var len = uint8.length`
`var extraBytes = len % 3 // if we have 1 byte left, pad 2 bytes`
`var parts = []`
`var maxChunkLength = 16383 // must be multiple of 3`
`// go through the array every three bytes, we'll deal with trailing stuff later`
`for (var i = 0, len2 = len - extraBytes; i < len2; i += maxChunkLength) {`
`parts.push(encodeChunk(uint8, i, (i + maxChunkLength) > len2 ? len2 : (i + maxChunkLength)))`
`}`
`return parts.join('')`
`}`

```

// pad the end with zeros, but make sure to not forget the extra bytes\n if (extraBytes === 1) {\n   tmp = uint8[len -
1]\n   parts.push(\n     lookup[tmp >> 2] +\n     lookup[(tmp << 4) & 0x3F] +\n     '='\n   )\n } else if (extraBytes
=== 2) {\n   tmp = (uint8[len - 2] << 8) + uint8[len - 1]\n   parts.push(\n     lookup[tmp >> 10] +\n     lookup[(tmp
>> 4) & 0x3F] +\n     lookup[(tmp << 2) & 0x3F] +\n     '='\n   )\n }\n\n return parts.join("")\n}\n", "exports.read =
function (buffer, offset, isLE, mLen, nBytes) {\n  var e, m\n  var eLen = (nBytes * 8) - mLen - 1\n  var eMax = (1
<< eLen) - 1\n  var eBias = eMax >> 1\n  var nBits = -7\n  var i = isLE ? (nBytes - 1) : 0\n  var d = isLE ? -1 : 1\n
var s = buffer[offset + i]\n  i += d\n  e = s & ((1 << (-nBits)) - 1)\n  s >>= (-nBits)\n  nBits += eLen\n  for (;
nBits > 0; e = (e * 256) + buffer[offset + i], i += d, nBits -= 8) {\n  }\n  m = e & ((1 << (-nBits)) - 1)\n  e >>= (-
nBits)\n  nBits += mLen\n  for (; nBits > 0; m = (m * 256) + buffer[offset + i], i += d, nBits -= 8) {\n  }\n  if (e ===
0) {\n    e = 1 - eBias\n  } else if (e === eMax) {\n    return m ? NaN : ((s ? -1 : 1) * Infinity)\n  } else {\n    m = m +
Math.pow(2, mLen)\n    e = e - eBias\n  }\n  return (s ? -1 : 1) * m * Math.pow(2, e - mLen)\n}\n\nexports.write =
function (buffer, value, offset, isLE, mLen, nBytes) {\n  var e, m, c\n  var eLen = (nBytes * 8) - mLen - 1\n  var
eMax = (1 << eLen) - 1\n  var eBias = eMax >> 1\n  var rt = (mLen === 23 ? Math.pow(2, -24) - Math.pow(2, -77) :
0)\n  var i = isLE ? 0 : (nBytes - 1)\n  var d = isLE ? 1 : -1\n  var s = value < 0 || (value === 0 && 1 / value < 0) ? 1 :
0\n  value = Math.abs(value)\n  if (isNaN(value) || value === Infinity) {\n    m = isNaN(value) ? 1 : 0\n    e =
eMax\n  } else {\n    e = Math.floor(Math.log(value) / Math.LN2)\n    if (value * (c = Math.pow(2, -e)) < 1) {\n      e-
\n      c *= 2\n    }\n    if (e + eBias >= 1) {\n      value += rt / c\n    } else {\n      value += rt * Math.pow(2, 1 -
eBias)\n    }\n    if (value * c >= 2) {\n      e++\n      c /= 2\n    }\n    if (e + eBias >= eMax) {\n      m = 0\n      e =
eMax\n    } else if (e + eBias >= 1) {\n      m = ((value * c) - 1) * Math.pow(2, mLen)\n      e = e + eBias\n    } else
{\n      m = value * Math.pow(2, eBias - 1) * Math.pow(2, mLen)\n      e = 0\n    }\n  }\n  for (; mLen >= 8;
buffer[offset + i] = m & 0xff, i += d, m /= 256, mLen -= 8) {\n  }\n  e = (e << mLen) | m\n  eLen += mLen\n  for (;
eLen > 0; buffer[offset + i] = e & 0xff, i += d, e /= 256, eLen -= 8) {\n  }\n  buffer[offset + i - d] |= s * 128\n}\n", "var
toString = {}.toString;\n\nmodule.exports = Array.isArray || function (arr) {\n  return toString.call(arr) === '[object
Array]';\n};\n", "/*!\n * The buffer module from node.js, for the browser.\n *!\n * @author Feross Aboukhadijeh
<feross@feross.org> <http://feross.org>\n * @license MIT\n */\n\n/* eslint-disable no-proto */\n\n'use strict'\n\nvar
base64 = require('base64-js')\n\nvar ieee754 = require('ieee754')\n\nvar isArray = require('isarray')\n\nexports.Buffer =
Buffer\n\nexports.SlowBuffer = SlowBuffer\n\nexports.INSPECT_MAX_BYTES = 50\n\n/**\n * If
`Buffer.TYPED_ARRAY_SUPPORT`:\n * === true Use Uint8Array implementation (fastest)\n * === false
Use Object implementation (most compatible, even IE6)\n *!\n * Browsers that support typed arrays are IE 10+,
Firefox 4+, Chrome 7+, Safari 5.1+,\n * Opera 11.6+, iOS 4.2+.\n *!\n * Due to various browser bugs, sometimes the
Object implementation will be used even\n * when the browser supports typed arrays.\n *!\n * Note:\n *!\n * -
Firefox 4-29 lacks support for adding new properties to `Uint8Array` instances,\n * See:
https://bugzilla.mozilla.org/show\_bug.cgi?id=695438.\n *!\n * - Chrome 9-10 is missing the
`TypedArray.prototype.subarray` function.\n *!\n * - IE10 has a broken `TypedArray.prototype.subarray` function
which returns arrays of\n * incorrect length in some situations.\n *!\n * We detect these buggy browsers and set
`Buffer.TYPED_ARRAY_SUPPORT` to `false` so they\n * get the Object implementation, which is slower but
behaves correctly.\n *!\n * Buffer.TYPED_ARRAY_SUPPORT = global.TYPED_ARRAY_SUPPORT !==
undefined\n * ? global.TYPED_ARRAY_SUPPORT\n * : typedArraySupport()\n *!\n * Export kMaxLength after
typed array support is determined.\n *!\n */\n\nexports.kMaxLength = kMaxLength()\n\nfunction typedArraySupport ()
{\n  try {\n    var arr = new Uint8Array(1)\n    arr.__proto__ = {__proto__: Uint8Array.prototype, foo: function () {\n
return 42 }}\n    return arr.foo() === 42 && // typed array instances can be augmented\n      typeof arr.subarray
=== 'function' && // chrome 9-10 lack `subarray`\n      arr.subarray(1, 1).byteLength === 0 // ie10 has broken
`subarray`\n  } catch (e) {\n    return false\n  }\n}\n\nfunction kMaxLength () {\n  return
Buffer.TYPED_ARRAY_SUPPORT\n  ? 0x7fffffff\n  : 0x3fffffff\n}\n\nfunction createBuffer (that, length) {\n
if (kMaxLength() < length) {\n  throw new RangeError('Invalid typed array length')\n }\n  if
(Buffer.TYPED_ARRAY_SUPPORT) {\n    // Return an augmented `Uint8Array` instance, for best performance\n
that = new Uint8Array(length)\n    that.__proto__ = Buffer.prototype\n  } else {\n    // Fallback: Return an object
instance of the Buffer class\n    if (that === null) {\n      that = new Buffer(length)\n    }\n    that.length = length\n

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}\n\n return that\n}\n\n/**\n * The Buffer constructor returns instances of `Uint8Array` that have their\n *
prototype changed to `Buffer.prototype`. Furthermore, `Buffer` is a subclass of\n * `Uint8Array`, so the returned
instances will have all the node `Buffer` methods\n * and the `Uint8Array` methods. Square bracket notation works
as expected -- it\n * returns a single octet.\n *\n * The `Uint8Array` prototype remains unmodified.\n */\n\nfunction
Buffer(arg, encodingOrOffset, length) {\n  if (!Buffer.TYPED_ARRAY_SUPPORT && !(this instanceof Buffer))\n  {\n    return new Buffer(arg, encodingOrOffset, length)\n  }\n\n  // Common case.\n  if (typeof arg === 'number') {\n    if (typeof encodingOrOffset === 'string') {\n      throw new Error(\n        'If encoding is specified then the first
argument must be a string'\n      )\n    }\n    return allocUnsafe(this, arg)\n  }\n  return from(this, arg,
encodingOrOffset, length)\n}\n\nBuffer.poolSize = 8192 // not used by this implementation\n\n// TODO: Legacy,
not needed anymore. Remove in next major version.\nBuffer._augment = function (arr) {\n  arr.__proto__ =
Buffer.prototype\n  return arr\n}\n\nfunction from (that, value, encodingOrOffset, length) {\n  if (typeof value ===
'number') {\n    throw new TypeError('"value" argument must not be a number')\n  }\n\n  if (typeof ArrayBuffer
!== 'undefined' && value instanceof ArrayBuffer) {\n    return fromArrayBuffer(that, value, encodingOrOffset,
length)\n  }\n\n  if (typeof value === 'string') {\n    return fromString(that, value, encodingOrOffset)\n  }\n\n  return
fromObject(that, value)\n}\n\n/**\n * Functionally equivalent to Buffer(arg, encoding) but throws a TypeError\n * if
value is a number.\n * Buffer.from(str[, encoding])\n * Buffer.from(array)\n * Buffer.from(buffer)\n *
Buffer.from(arrayBuffer[, byteOffset[, length]])\n */\n\nBuffer.from = function (value, encodingOrOffset, length) {\n
return from(null, value, encodingOrOffset, length)\n}\n\nif (Buffer.TYPED_ARRAY_SUPPORT) {\n
Buffer.prototype.__proto__ = Uint8Array.prototype\n  Buffer.__proto__ = Uint8Array\n  if (typeof Symbol !==
'undefined' && Symbol.species &&\n    Buffer[Symbol.species] === Buffer) {\n    // Fix subarray() in ES2016.
See: https://github.com/feross/buffer/pull/97\n    Object.defineProperty(Buffer, Symbol.species, {\n      value: null,\n
configurable: true\n    })\n  }\n}\n\nfunction assertSize (size) {\n  if (typeof size !== 'number') {\n    throw new
TypeError('"size" argument must be a number')\n  } else if (size < 0) {\n    throw new RangeError('"size"
argument must not be negative')\n  }\n}\n\nfunction alloc (that, size, fill, encoding) {\n  assertSize(size)\n  if (size
<= 0) {\n    return createBuffer(that, size)\n  }\n  if (fill !== undefined) {\n    // Only pay attention to encoding if it's
a string. This\n    // prevents accidentally sending in a number that would\n    // be interpreted as a start offset.\n
return typeof encoding === 'string'\n      ? createBuffer(that, size).fill(fill, encoding)\n      : createBuffer(that,
size).fill(fill)\n  }\n  return createBuffer(that, size)\n}\n\n/**\n * Creates a new filled Buffer instance.\n * alloc(size[,
fill[, encoding]])\n */\n\nBuffer.alloc = function (size, fill, encoding) {\n  return alloc(null, size, fill,
encoding)\n}\n\nfunction allocUnsafe (that, size) {\n  assertSize(size)\n  that = createBuffer(that, size < 0 ? 0 :
checked(size) | 0)\n  if (!Buffer.TYPED_ARRAY_SUPPORT) {\n    for (var i = 0; i < size; ++i) {\n      that[i] = 0\n    }\n  }\n  return that\n}\n\n/**\n * Equivalent to Buffer(num), by default creates a non-zero-filled Buffer instance.\n
*\n * Buffer.allocUnsafe = function (size) {\n  return allocUnsafe(null, size)\n}\n */\n\n/**\n * Equivalent to
SlowBuffer(num), by default creates a non-zero-filled Buffer instance.\n */\n\nBuffer.allocUnsafeSlow = function
(size) {\n  return allocUnsafe(null, size)\n}\n\nfunction fromString (that, string, encoding) {\n  if (typeof encoding
!== 'string' || encoding === '') {\n    encoding = 'utf8'\n  }\n\n  if (!Buffer.isEncoding(encoding)) {\n    throw new
TypeError('"encoding" must be a valid string encoding')\n  }\n\n  var length = byteLength(string, encoding) | 0\n  that =
createBuffer(that, length)\n\n  var actual = that.write(string, encoding)\n\n  if (actual !== length) {\n    //
Writing a hex string, for example, that contains invalid characters will\n    // cause everything after the first invalid
character to be ignored. (e.g.\n    // 'abxcd' will be treated as 'ab')\n    that = that.slice(0, actual)\n  }\n\n  return
that\n}\n\nfunction fromArrayLike (that, array) {\n  var length = array.length < 0 ? 0 : checked(array.length) | 0\n  that =
createBuffer(that, length)\n  for (var i = 0; i < length; i += 1) {\n    that[i] = array[i] & 255\n  }\n  return
that\n}\n\nfunction fromArrayBuffer (that, array, byteOffset, length) {\n  array.byteLength // this throws if `array` is
not a valid ArrayBuffer\n\n  if (byteOffset < 0 || array.byteLength < byteOffset) {\n    throw new
RangeError('"offset" is out of bounds')\n  }\n\n  if (array.byteLength < byteOffset + (length || 0)) {\n    throw new
RangeError('"length" is out of bounds')\n  }\n\n  if (byteOffset === undefined && length === undefined) {\n
array = new Uint8Array(array)\n  } else if (length === undefined) {\n    array = new Uint8Array(array, byteOffset)\n  }
else {\n    array = new Uint8Array(array, byteOffset, length)\n  }\n\n  if (Buffer.TYPED_ARRAY_SUPPORT) {\n

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// Return an augmented `Uint8Array` instance, for best performance
that = array
that.__proto__ =
Buffer.prototype
} else {
// Fallback: Return an object instance of the Buffer class
that =
fromArrayLike(that, array)
}
return that
}
function fromObject (that, obj) {
if (Buffer.isBuffer(obj)) {
var len = checked(obj.length) | 0
that = createBuffer(that, len)
if (that.length === 0) {
return that
}
obj.copy(that, 0, 0, len)
return that
}
if (obj) {
if ((typeof ArrayBuffer !== 'undefined' &&
obj.buffer instanceof ArrayBuffer) || 'length' in obj) {
if (typeof obj.length !== 'number' || !isn(obj.length))
return createBuffer(that, 0)
}
return fromArrayLike(that, obj)
}
if (obj.type === 'Buffer'
&& isArray(obj.data)) {
return fromArrayLike(that, obj.data)
}
}
throw new TypeError('First
argument must be a string, Buffer, ArrayBuffer, Array, or array-like object.')
}
function checked (length) {
// Note: cannot use `length < kMaxLength()` here because that fails when
// length is NaN (which is otherwise
coerced to zero.)
if (length >= kMaxLength()) {
throw new RangeError('Attempt to allocate Buffer larger than
maximum ' +
'size: 0x' + kMaxLength().toString(16) + ' bytes')
}
return length |
0
}
function SlowBuffer (length) {
if (+length !== length) { // eslint-disable-line eqeqeq
length = 0
}
return Buffer.alloc(+length)
}
Buffer.isBuffer = function isBuffer (b) {
return !! (b != null &&
b._isBuffer)
}
Buffer.compare = function compare (a, b) {
if (!Buffer.isBuffer(a) || !Buffer.isBuffer(b)) {
throw new TypeError('Arguments must be Buffers')
}
if (a === b) return 0
var x = a.length
var y =
b.length
for (var i = 0, len = Math.min(x, y); i < len; ++i) {
if (a[i] !== b[i]) {
x = a[i]
y = b[i]
break
}
}
if (x < y) return -1
if (y < x) return 1
return 0
}
Buffer.isEncoding = function
isEncoding (encoding) {
switch (String(encoding).toLowerCase()) {
case 'hex':
case 'utf8':
case 'utf-
8':
case 'ascii':
case 'latin1':
case 'binary':
case 'base64':
case 'ucs2':
case 'ucs-2':
case
'utf16le':
case 'utf-16le':
return true
default:
return false
}
}
Buffer.concat = function concat
(list, length) {
if (!isArray(list)) {
throw new TypeError('"list"
argument must be an Array of Buffers')
}
if (list.length === 0) {
return Buffer.alloc(0)
}
var i
if (length === undefined) {
length = 0
for (i = 0; i < list.length; ++i) {
length += list[i].length
}
}
var buffer = Buffer.allocUnsafe(length)
var pos = 0
for (i = 0; i < list.length; ++i) {
var buf = list[i]
if (!Buffer.isBuffer(buf)) {
throw new
TypeError('"list"
argument must be an Array of Buffers')
}
buf.copy(buffer, pos)
pos += buf.length
}
return buffer
}
function byteLength (string, encoding) {
if (Buffer.isBuffer(string)) {
return
string.length
}
if (typeof ArrayBuffer !== 'undefined' && typeof ArrayBuffer.isView === 'function' &&
(ArrayBuffer.isView(string) || string instanceof ArrayBuffer)) {
return string.byteLength
}
if (typeof string
!== 'string') {
string = '' + string
}
var len = string.length
if (len === 0) return 0
// Use a for loop to
avoid recursion
var loweredCase = false
for (;;) {
switch (encoding) {
case 'ascii':
case 'latin1':
case 'binary':
return len
case 'utf8':
case 'utf-8':
return
utf8ToBytes(string).length
case 'ucs2':
case 'ucs-2':
case 'utf16le':
case 'utf-16le':
return
len * 2
case 'hex':
return len >>> 1
case 'base64':
return base64ToBytes(string).length
default:
if (loweredCase) return utf8ToBytes(string).length // assume utf8
encoding = (' +
encoding).toLowerCase()
loweredCase = true
}
}
}
Buffer.byteLength = byteLength
function
slowToString (encoding, start, end) {
var loweredCase = false
// No need to verify that "this.length <=
MAX_UINT32" since it's a read-only
// property of a typed array.
// This behaves neither like String nor
Uint8Array in that we set start/end
// to their upper/lower bounds if the value passed is out of range.
//
// undefined is handled specially as per ECMA-262 6th Edition,
// Section 13.3.3.7 Runtime Semantics:
KeyedBindingInitialization.
if (start === undefined || start < 0) {
start = 0
}
// Return early if start >
this.length. Done here to prevent potential uint32
// coercion fail below.
if (start > this.length) {
return ""
}
if (end === undefined || end > this.length) {
end = this.length
}
if (end <= 0) {
return ""
}
// Force coercion to uint32. This will also coerce falsey/NaN values to 0.
end >>>= 0
start >>>= 0
if (end
<= start) {
return ""
}
if (!encoding) encoding = 'utf8'
while (true) {
switch (encoding) {
case
'hex':
return hexSlice(this, start, end)
case 'utf8':
case 'utf-8':
return utf8Slice(this, start,
end)
case 'ascii':
return asciiSlice(this, start, end)
case 'latin1':
case 'binary':
return
latin1Slice(this, start, end)
case 'base64':
return base64Slice(this, start, end)
case 'ucs2':

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case 'ucs-2':\n case 'utf16le':\n case 'utf-16le':\n return utf16leSlice(this, start, end)\n\n default:\n if
(loweredCase) throw new TypeError("Unknown encoding: " + encoding)\n encoding = (encoding +
").toLowerCase()\n loweredCase = true\n }\n }\n}\n\n// The property is used by `Buffer.isBuffer` and `is-
buffer` (in Safari 5-7) to detect\n// Buffer instances.\nBuffer.prototype._isBuffer = true\n\nfunction swap (b, n, m)
{\n var i = b[n]\n b[n] = b[m]\n b[m] = i\n}\n\nBuffer.prototype.swap16 = function swap16 () {\n var len =
this.length\n if (len % 2 !== 0) {\n throw new RangeError("Buffer size must be a multiple of 16-bits")\n }\n for
(var i = 0; i < len; i += 2) {\n swap(this, i, i + 1)\n }\n return this\n}\n\nBuffer.prototype.swap32 = function
swap32 () {\n var len = this.length\n if (len % 4 !== 0) {\n throw new RangeError("Buffer size must be a multiple
of 32-bits")\n }\n for (var i = 0; i < len; i += 4) {\n swap(this, i, i + 3)\n swap(this, i + 1, i + 2)\n }\n return
this\n}\n\nBuffer.prototype.swap64 = function swap64 () {\n var len = this.length\n if (len % 8 !== 0) {\n throw
new RangeError("Buffer size must be a multiple of 64-bits")\n }\n for (var i = 0; i < len; i += 8) {\n swap(this, i,
i + 7)\n swap(this, i + 1, i + 6)\n swap(this, i + 2, i + 5)\n swap(this, i + 3, i + 4)\n }\n return
this\n}\n\nBuffer.prototype.toString = function toString () {\n var length = this.length | 0\n if (length === 0) return
""\n if (arguments.length === 0) return utf8Slice(this, 0, length)\n return slowToString.apply(this,
arguments)\n}\n\nBuffer.prototype.equals = function equals (b) {\n if (!Buffer.isBuffer(b)) throw new
TypeError("Argument must be a Buffer")\n if (this === b) return true\n return Buffer.compare(this, b) ===
0\n}\n\nBuffer.prototype.inspect = function inspect () {\n var str = "\n var max =
exports.INSPECT_MAX_BYTES\n if (this.length > 0) {\n str = this.toString('hex', 0, max).match(/.{2}/g).join('
')\n if (this.length > max) str += ' ... '\n }\n return '<Buffer ' + str + '>'\n}\n\nBuffer.prototype.compare = function
compare (target, start, end, thisStart, thisEnd) {\n if (!Buffer.isBuffer(target)) {\n throw new
TypeError("Argument must be a Buffer")\n }\n\n if (start === undefined) {\n start = 0\n }\n if (end ===
undefined) {\n end = target ? target.length : 0\n }\n if (thisStart === undefined) {\n thisStart = 0\n }\n if
(thisEnd === undefined) {\n thisEnd = this.length\n }\n\n if (start < 0 || end > target.length || thisStart < 0 ||
thisEnd > this.length) {\n throw new RangeError("out of range index")\n }\n\n if (thisStart >= thisEnd && start
>= end) {\n return 0\n }\n if (thisStart >= thisEnd) {\n return -1\n }\n if (start >= end) {\n return 1\n }\n\n start
>>>= 0\n end >>>= 0\n thisStart >>>= 0\n thisEnd >>>= 0\n if (this === target) return 0\n\n var x =
thisEnd - thisStart\n var y = end - start\n var len = Math.min(x, y)\n\n var thisCopy = this.slice(thisStart,
thisEnd)\n var targetCopy = target.slice(start, end)\n\n for (var i = 0; i < len; ++i) {\n if (thisCopy[i] !==
targetCopy[i]) {\n x = thisCopy[i]\n y = targetCopy[i]\n break\n }\n }\n\n if (x < y) return -1\n if (y <
x) return 1\n return 0\n}\n\n// Finds either the first index of `val` in `buffer` at offset >= `byteOffset`,\n// OR the last
index of `val` in `buffer` at offset <= `byteOffset`.\n// Arguments:\n// - buffer - a Buffer to search\n// - val - a
string, Buffer, or number\n// - byteOffset - an index into `buffer`; will be clamped to an int32\n// - encoding - an
optional encoding, relevant if val is a string\n// - dir - true for indexOf, false for lastIndexOf\n\nfunction
bidirectionalIndexOf (buffer, val, byteOffset, encoding, dir) {\n // Empty buffer means no match\n if (buffer.length
=== 0) return -1\n\n // Normalize byteOffset\n if (typeof byteOffset === 'string') {\n encoding = byteOffset\n
byteOffset = 0\n } else if (byteOffset > 0x7fffffff) {\n byteOffset = 0x7fffffff\n } else if (byteOffset < -
0x80000000) {\n byteOffset = -0x80000000\n }\n byteOffset = +byteOffset // Coerce to Number.\n if
(isNaN(byteOffset)) {\n // byteOffset: it's undefined, null, NaN, "foo", etc, search whole buffer\n byteOffset
= dir ? 0 : (buffer.length - 1)\n }\n\n // Normalize byteOffset: negative offsets start from the end of the buffer\n if
(byteOffset < 0) byteOffset = buffer.length + byteOffset\n if (byteOffset >= buffer.length) {\n if (dir) return -1\n
else byteOffset = buffer.length - 1\n } else if (byteOffset < 0) {\n if (dir) byteOffset = 0\n else return -1\n }\n\n // Normalize val\n if (typeof val === 'string') {\n val = Buffer.from(val, encoding)\n }\n\n // Finally, search
either indexOf (if dir is true) or lastIndexOf\n if (Buffer.isBuffer(val)) {\n // Special case: looking for empty
string/buffer always fails\n if (val.length === 0) {\n return -1\n }\n return arrayIndexOf(buffer, val,
byteOffset, encoding, dir)\n } else if (typeof val === 'number') {\n val = val & 0xFF // Search for a byte value [0-
255]\n if (Buffer.TYPED_ARRAY_SUPPORT &&\n typeof Uint8Array.prototype.indexOf === 'function')\n {\n if (dir) {\n
return Uint8Array.prototype.indexOf.call(buffer, val, byteOffset)\n } else {\n return
Uint8Array.prototype.lastIndexOf.call(buffer, val, byteOffset)\n }\n }\n\n return arrayIndexOf(buffer, [ val ],

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byteOffset, encoding, dir)\n }\n\n throw new TypeError('val must be string, number or Buffer')\n}\n\nfunction
arrayIndexOf (arr, val, byteOffset, encoding, dir) {\n  var indexSize = 1\n  var arrLength = arr.length\n  var
valLength = val.length\n\n  if (encoding !== undefined) {\n    encoding = String(encoding).toLowerCase()\n    if
(encoding === 'ucs2' || encoding === 'ucs-2' ||\n      encoding === 'utf16le' || encoding === 'utf-16le') {\n      if
(arr.length < 2 || val.length < 2) {\n        return -1\n      }\n      indexSize = 2\n      arrLength /= 2\n      valLength /=
2\n      byteOffset /= 2\n    }\n  }\n\n  function read (buf, i) {\n    if (indexSize === 1) {\n      return buf[i]\n    } else
{\n      return buf.readUInt16BE(i * indexSize)\n    }\n  }\n\n  var i\n  if (dir) {\n    var foundIndex = -1\n    for (i =
byteOffset; i < arrLength; i++) {\n      if (read(arr, i) === read(val, foundIndex === -1 ? 0 : i - foundIndex)) {\n
if (foundIndex === -1) foundIndex = i\n        if (i - foundIndex + 1 === valLength) return foundIndex * indexSize\n
      } else {\n        if (foundIndex !== -1) i -= i - foundIndex\n        foundIndex = -1\n      }\n    } else {\n      if
(byteOffset + valLength > arrLength) byteOffset = arrLength - valLength\n      for (i = byteOffset; i >= 0; i--) {\n
var found = true\n        for (var j = 0; j < valLength; j++) {\n          if (read(arr, i + j) !== read(val, j)) {\n            found =
false\n              break\n            }\n          }\n          if (found) return i\n        }\n        return -1\n      }\n    }\n  }\n\n  Buffer.prototype.includes =
function includes (val, byteOffset, encoding) {\n    return this.indexOf(val, byteOffset, encoding) !== -
1\n  }\n\n  Buffer.prototype.indexOf = function indexOf (val, byteOffset, encoding) {\n    return
bidirectionalIndexOf(this, val, byteOffset, encoding, true)\n  }\n\n  Buffer.prototype.lastIndexOf = function
lastIndexOf (val, byteOffset, encoding) {\n    return bidirectionalIndexOf(this, val, byteOffset, encoding,
false)\n  }\n\n  function hexWrite (buf, string, offset, length) {\n    offset = Number(offset) || 0\n    var remaining =
buf.length - offset\n    if (!length) {\n      length = remaining\n    } else {\n      length = Number(length)\n      if (length >
remaining) {\n        length = remaining\n      }\n    }\n\n    // must be an even number of digits\n    var strLen =
string.length\n    if (strLen % 2 !== 0) throw new TypeError('Invalid hex string')\n\n    if (length > strLen / 2) {\n
length = strLen / 2\n    }\n    for (var i = 0; i < length; ++i) {\n      var parsed = parseInt(string.substr(i * 2, 2), 16)\n      if
(isNaN(parsed)) return i\n      buf[offset + i] = parsed\n    }\n    return i\n  }\n\n  function utf8Write (buf, string, offset,
length) {\n    return blitBuffer(utf8ToBytes(string, buf.length - offset), buf, offset, length)\n  }\n\n  function asciiWrite
(buf, string, offset, length) {\n    return blitBuffer(asciiToBytes(string), buf, offset, length)\n  }\n\n  function latin1Write
(buf, string, offset, length) {\n    return asciiWrite(buf, string, offset, length)\n  }\n\n  function base64Write (buf, string,
offset, length) {\n    return blitBuffer(base64ToBytes(string), buf, offset, length)\n  }\n\n  function ucs2Write (buf,
string, offset, length) {\n    return blitBuffer(utf16leToBytes(string, buf.length - offset), buf, offset,
length)\n  }\n\n  Buffer.prototype.write = function write (string, offset, length, encoding) {\n    // Buffer#write(string)\n    if
(offset === undefined) {\n      encoding = 'utf8'\n      length = this.length\n      offset = 0\n      // Buffer#write(string,
encoding)\n    } else if (length === undefined && typeof offset === 'string') {\n      encoding = offset\n      length =
this.length\n      offset = 0\n      // Buffer#write(string, offset[, length][, encoding])\n    } else if (isFinite(offset)) {\n
offset = offset | 0\n      if (isFinite(length)) {\n        length = length | 0\n        if (encoding === undefined) encoding =
'utf8'\n      } else {\n        encoding = length\n        length = undefined\n      }\n      // legacy write(string, encoding, offset,
length) - remove in v0.13\n    } else {\n      throw new Error('\n      Buffer.write(string, encoding, offset[, length]) is no
longer supported\n    )\n    }\n\n    var remaining = this.length - offset\n    if (length === undefined || length >
remaining) length = remaining\n\n    if ((string.length > 0 && (length < 0 || offset < 0)) || offset > this.length) {\n
throw new RangeError('Attempt to write outside buffer bounds')\n    }\n\n    if (!encoding) encoding = 'utf8'\n    var
loweredCase = false\n    for (;;) {\n      switch (encoding) {\n        case 'hex':\n          return hexWrite(this, string, offset,
length)\n\n        case 'utf8':\n        case 'utf-8':\n          return utf8Write(this, string, offset, length)\n\n        case 'ascii':\n          return
asciiWrite(this, string, offset, length)\n\n        case 'latin1':\n        case 'binary':\n          return latin1Write(this,
string, offset, length)\n\n        case 'base64':\n          // Warning: maxLength not taken into account in base64Write\n          return
base64Write(this, string, offset, length)\n\n        case 'ucs2':\n        case 'ucs-2':\n        case 'utf16le':\n        case 'utf-
16le':\n          return ucs2Write(this, string, offset, length)\n\n        default:\n          if (loweredCase) throw new
TypeError('Unknown encoding: ' + encoding)\n          encoding = (" + encoding).toLowerCase()\n          loweredCase =
true\n        }\n      }\n    }\n  }\n\n  Buffer.prototype.toJSON = function toJSON () {\n    return {\n      type: 'Buffer',\n      data:
Array.prototype.slice.call(this._arr || this, 0)\n    }\n  }\n\n  function base64Slice (buf, start, end) {\n    if (start === 0 &&
end === buf.length) {\n      return base64.fromByteArray(buf)\n    } else {\n      return

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base64.fromByteArray(buf.slice(start, end))\n } }\n\nfunction utf8Slice (buf, start, end) {\n end =
Math.min(buf.length, end)\n var res = []\n var i = start\n while (i < end) {\n var firstByte = buf[i]\n var
codePoint = null\n var bytesPerSequence = (firstByte > 0xEF) ? 4\n : (firstByte > 0xDF) ? 3\n : (firstByte >
0xBF) ? 2\n : 1\n\n if (i + bytesPerSequence <= end) {\n var secondByte, thirdByte, fourthByte,
tempCodePoint\n\n switch (bytesPerSequence) {\n case 1:\n if (firstByte < 0x80) {\n codePoint
= firstByte\n }\n break\n case 2:\n secondByte = buf[i + 1]\n if ((secondByte & 0xC0)
=== 0x80) {\n tempCodePoint = (firstByte & 0x1F) << 0x6 | (secondByte & 0x3F)\n if
(tempCodePoint > 0x7F) {\n codePoint = tempCodePoint\n }\n }\n break\n case 3:\n
secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte
& 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0xC | (secondByte & 0x3F) << 0x6 |
(thirdByte & 0x3F)\n if (tempCodePoint > 0x7FF && (tempCodePoint < 0xD800 || tempCodePoint >
0xDFFF)) {\n codePoint = tempCodePoint\n }\n }\n break\n case 4:\n
secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n fourthByte = buf[i + 3]\n if ((secondByte &
0xC0) === 0x80 && (thirdByte & 0xC0) === 0x80 && (fourthByte & 0xC0) === 0x80) {\n tempCodePoint
= (firstByte & 0xF) << 0x12 | (secondByte & 0x3F) << 0xC | (thirdByte & 0x3F) << 0x6 | (fourthByte & 0x3F)\n
if (tempCodePoint > 0xFFFF && tempCodePoint < 0x110000) {\n codePoint = tempCodePoint\n
}\n }\n }\n }\n\n if (codePoint === null) {\n // we did not generate a valid codePoint so insert a\n
// replacement char (U+FFFD) and advance only 1 byte\n codePoint = 0xFFFD\n bytesPerSequence = 1\n }
else if (codePoint > 0xFFFF) {\n // encode to utf16 (surrogate pair dance)\n codePoint -= 0x10000\n
res.push(codePoint >>> 10 & 0x3FF | 0xD800)\n codePoint = 0xDC00 | codePoint & 0x3FF\n }\n\n
res.push(codePoint)\n i += bytesPerSequence\n }\n\n return decodeCodePointsArray(res)\n}\n\n// Based on
http://stackoverflow.com/a/22747272/680742, the browser with\n// the lowest limit is Chrome, with 0x10000
args.\n// We go 1 magnitude less, for safety\nvar MAX_ARGUMENTS_LENGTH = 0x1000\n\nfunction
decodeCodePointsArray (codePoints) {\n var len = codePoints.length\n if (len <=
MAX_ARGUMENTS_LENGTH) {\n return String.fromCharCode.apply(String, codePoints) // avoid extra
slice()\n }\n\n // Decode in chunks to avoid "call stack size exceeded"\n var res = "\n var i = 0\n while (i < len)
{\n res += String.fromCharCode.apply(\n String,\n codePoints.slice(i, i +=
MAX_ARGUMENTS_LENGTH)\n )\n }\n return res\n}\n\nfunction asciiSlice (buf, start, end) {\n var ret = "\n
end = Math.min(buf.length, end)\n\n for (var i = start; i < end; ++i) {\n ret += String.fromCharCode(buf[i] &
0x7F)\n }\n return ret\n}\n\nfunction latin1Slice (buf, start, end) {\n var ret = "\n end = Math.min(buf.length,
end)\n\n for (var i = start; i < end; ++i) {\n ret += String.fromCharCode(buf[i])\n }\n return ret\n}\n\nfunction
hexSlice (buf, start, end) {\n var len = buf.length\n\n if (!start || start < 0) start = 0\n if (!end || end < 0 || end > len)
end = len\n\n var out = "\n for (var i = start; i < end; ++i) {\n out += toHex(buf[i])\n }\n return
out\n}\n\nfunction utf16leSlice (buf, start, end) {\n var bytes = buf.slice(start, end)\n var res = "\n for (var i = 0; i <
bytes.length; i += 2) {\n res += String.fromCharCode(bytes[i] + bytes[i + 1] * 256)\n }\n return
res\n}\n\nBuffer.prototype.slice = function slice (start, end) {\n var len = this.length\n start = ~~start\n end = end
=== undefined ? len : ~~end\n\n if (start < 0) {\n start += len\n if (start < 0) start = 0\n } else if (start > len) {\n
start = len\n }\n\n if (end < 0) {\n end += len\n if (end < 0) end = 0\n } else if (end > len) {\n end = len\n
}\n\n if (end < start) end = start\n\n var newBuf\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n newBuf =
this.subarray(start, end)\n newBuf.__proto__ = Buffer.prototype\n } else {\n var sliceLen = end - start\n
newBuf = new Buffer(sliceLen, undefined)\n for (var i = 0; i < sliceLen; ++i) {\n newBuf[i] = this[i + start]\n
}\n }\n\n return newBuf\n}\n\n/*\n * Need to make sure that buffer isn't trying to write out of bounds.\n
*\n\nfunction checkOffset (offset, ext, length) {\n if ((offset % 1) !== 0 || offset < 0) throw new RangeError('offset is
not uint')\n if (offset + ext > length) throw new RangeError('Trying to access beyond buffer
length')\n }\n\nBuffer.prototype.readUIntLE = function readUIntLE (offset, byteLength, noAssert) {\n offset =
offset | 0\n byteLength = byteLength | 0\n if (!noAssert) checkOffset(offset, byteLength, this.length)\n\n var val =
this[offset]\n var mul = 1\n var i = 0\n while (++i < byteLength && (mul *= 0x100)) {\n val += this[offset + i] *
mul\n }\n\n return val\n}\n\nBuffer.prototype.readUIntBE = function readUIntBE (offset, byteLength, noAssert)

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{\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) {\n    checkOffset(offset, byteLength,
this.length)\n  }\n\n  var val = this[offset + --byteLength]\n  var mul = 1\n  while (byteLength > 0 && (mul *=
0x100)) {\n    val += this[offset + --byteLength] * mul\n  }\n\n  return val\n}\n\nBuffer.prototype.readUInt8 =
function readUInt8 (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 1, this.length)\n  return
this[offset]\n}\n\nBuffer.prototype.readUInt16LE = function readUInt16LE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  return this[offset] | (this[offset + 1] <<
8)\n}\n\nBuffer.prototype.readUInt16BE = function readUInt16BE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  return (this[offset] << 8) | this[offset + 1]\n}\n\nBuffer.prototype.readUInt32LE
= function readUInt32LE (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 4, this.length)\n  return
((this[offset]) |\n    (this[offset + 1] << 8) |\n    (this[offset + 2] << 16)) +\n    (this[offset + 3] *
0x1000000)\n}\n\nBuffer.prototype.readUInt32BE = function readUInt32BE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 4, this.length)\n  return (this[offset] * 0x1000000) +\n    ((this[offset + 1] << 16) |\n    (this[offset + 2] << 8) |\n    this[offset + 3])\n}\n\nBuffer.prototype.readIntLE = function readIntLE (offset,
byteLength, noAssert) {\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset,
byteLength, this.length)\n  var val = this[offset]\n  var mul = 1\n  var i = 0\n  while (++i < byteLength && (mul *=
0x100)) {\n    val += this[offset + i] * mul\n  }\n  mul *= 0x80\n  if (val >= mul) val -= Math.pow(2, 8 *
byteLength)\n  return val\n}\n\nBuffer.prototype.readIntBE = function readIntBE (offset, byteLength, noAssert)
{\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength,
this.length)\n  var i = byteLength\n  var mul = 1\n  var val = this[offset + --i]\n  while (i > 0 && (mul *= 0x100))
{\n    val += this[offset + --i] * mul\n  }\n  mul *= 0x80\n  if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n  return
val\n}\n\nBuffer.prototype.readInt8 = function readInt8 (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 1, this.length)\n  if (!(this[offset] & 0x80)) return (this[offset])\n  return ((0xff - this[offset] + 1)
* -1)\n}\n\nBuffer.prototype.readInt16LE = function readInt16LE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  var val = this[offset] | (this[offset + 1] << 8)\n  return (val & 0x8000) ? val |
0xFFFF0000 : val\n}\n\nBuffer.prototype.readInt16BE = function readInt16BE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  var val = this[offset + 1] | (this[offset] << 8)\n  return (val & 0x8000) ? val |
0xFFFF0000 : val\n}\n\nBuffer.prototype.readInt32LE = function readInt32LE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 4, this.length)\n  return (this[offset]) |\n    (this[offset + 1] << 8) |\n    (this[offset + 2] << 16)
|\n    (this[offset + 3] << 24)\n}\n\nBuffer.prototype.readInt32BE = function readInt32BE (offset, noAssert) {\n  if
(!noAssert) checkOffset(offset, 4, this.length)\n  return (this[offset] << 24) |\n    (this[offset + 1] << 16) |\n    (this[offset + 2] << 8) |\n    (this[offset + 3])\n}\n\nBuffer.prototype.readFloatLE = function readFloatLE (offset,
noAssert) {\n  if (!noAssert) checkOffset(offset, 4, this.length)\n  return ieee754.read(this, offset, true, 23,
4)\n}\n\nBuffer.prototype.readFloatBE = function readFloatBE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 4, this.length)\n  return ieee754.read(this, offset, false, 23,
4)\n}\n\nBuffer.prototype.readDoubleLE = function readDoubleLE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 8, this.length)\n  return ieee754.read(this, offset, true, 52,
8)\n}\n\nBuffer.prototype.readDoubleBE = function readDoubleBE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 8, this.length)\n  return ieee754.read(this, offset, false, 52, 8)\n}\n\nfunction checkInt (buf,
value, offset, ext, max, min) {\n  if (!Buffer.isBuffer(buf)) throw new TypeError('"buffer" argument must be a
Buffer instance')\n  if (value > max || value < min) throw new RangeError('"value" argument is out of bounds')\n  if
(offset + ext > buf.length) throw new RangeError('Index out of range')\n}\n\nBuffer.prototype.writeUIntLE =
function writeUIntLE (value, offset, byteLength, noAssert) {\n  value = +value\n  offset = offset | 0\n  byteLength =
byteLength | 0\n  if (!noAssert) {\n    var maxBytes = Math.pow(2, 8 * byteLength) - 1\n    checkInt(this, value,
offset, byteLength, maxBytes, 0)\n  }\n  var mul = 1\n  var i = 0\n  this[offset] = value & 0xFF\n  while (++i <
byteLength && (mul *= 0x100)) {\n    this[offset + i] = (value / mul) & 0xFF\n  }\n  return offset +
byteLength\n}\n\nBuffer.prototype.writeUIntBE = function writeUIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) {\n    var maxBytes =
Math.pow(2, 8 * byteLength) - 1\n    checkInt(this, value, offset, byteLength, maxBytes, 0)\n  }\n  var i =

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byteLength - 1\n var mul = 1\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *= 0x100)) {\n
this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeUInt8 =
function writeUInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this,
value, offset, 1, 0xff, 0)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n this[offset] =
(value & 0xff)\n return offset + 1\n}\n\nfunction objectWriteUInt16 (buf, value, offset, littleEndian) {\n if (value <
0) value = 0xffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 2); i < j; ++i) {\n buf[offset + i] =
(value & (0xff << (8 * (littleEndian ? i : 1 - i)))) >>>\n (littleEndian ? i : 1 - i) * 8\n
}\n}\n\nBuffer.prototype.writeUInt16LE = function writeUInt16LE (value, offset, noAssert) {\n value = +value\n
offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0xffff, 0)\n if
(Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n }
else {\n objectWriteUInt16(this, value, offset, true)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeUInt16BE
= function writeUInt16BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0xffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>>
8)\n this[offset + 1] = (value & 0xff)\n } else {\n objectWriteUInt16(this, value, offset, false)\n }\n return
offset + 2\n}\n\nfunction objectWriteUInt32 (buf, value, offset, littleEndian) {\n if (value < 0) value = 0xffffffff +
value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 4); i < j; ++i) {\n buf[offset + i] = (value >>>
(littleEndian ? i : 3 - i) * 8) & 0xff\n }\n}\n\nBuffer.prototype.writeUInt32LE = function writeUInt32LE (value,
offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4, 0xffffffff,
0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset + 3] = (value >>> 24)\n this[offset + 2] = (value
>>> 16)\n this[offset + 1] = (value >>> 8)\n this[offset] = (value & 0xff)\n } else {\n objectWriteUInt32(this,
value, offset, true)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeUInt32BE = function writeUInt32BE (value,
offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4, 0xffffffff,
0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>> 24)\n this[offset + 1] = (value >>>
16)\n this[offset + 2] = (value >>> 8)\n this[offset + 3] = (value & 0xff)\n } else {\n objectWriteUInt32(this,
value, offset, false)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeIntLE = function writeIntLE (value, offset,
byteLength, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) {\n var limit = Math.pow(2, 8 *
byteLength - 1)\n checkInt(this, value, offset, byteLength, limit - 1, -limit)\n }\n\n var i = 0\n var mul = 1\n
var sub = 0\n this[offset] = value & 0xFF\n while (++i < byteLength && (mul *= 0x100)) {\n if (value < 0 &&
sub === 0 && this[offset + i - 1] !== 0) {\n sub = 1\n }\n this[offset + i] = ((value / mul) >> 0) - sub &
0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeIntBE = function writeIntBE (value, offset,
byteLength, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) {\n var limit = Math.pow(2, 8 *
byteLength - 1)\n checkInt(this, value, offset, byteLength, limit - 1, -limit)\n }\n\n var i = byteLength - 1\n var
mul = 1\n var sub = 0\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *= 0x100)) {\n if (value < 0
&& sub === 0 && this[offset + i + 1] !== 0) {\n sub = 1\n }\n this[offset + i] = ((value / mul) >> 0) - sub &
0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeInt8 = function writeInt8 (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 1, 0x7f, -0x80)\n if
(!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n if (value < 0) value = 0xff + value + 1\n
this[offset] = (value & 0xff)\n return offset + 1\n}\n\nBuffer.prototype.writeInt16LE = function writeInt16LE
(value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2,
0x7fff, -0x8000)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value & 0xff)\n this[offset + 1] =
(value >>> 8)\n } else {\n objectWriteUInt16(this, value, offset, true)\n }\n return offset +
2\n}\n\nBuffer.prototype.writeInt16BE = function writeInt16BE (value, offset, noAssert) {\n value = +value\n
offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n if
(Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>> 8)\n this[offset + 1] = (value & 0xff)\n }
else {\n objectWriteUInt16(this, value, offset, false)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt32LE
= function writeInt32LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0x7fffffff, -0x80000000)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n this[offset + 2] = (value >>> 16)\n this[offset

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+ 3] = (value >>> 24)\n } else {\n   objectWriteUInt32(this, value, offset, true)\n }\n return offset +
4\n}\n\nBuffer.prototype.writeInt32BE = function writeInt32BE (value, offset, noAssert) {\n value = +value\n
offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4, 0x7fffffff, -0x80000000)\n if (value < 0) value =
0xffffffff + value + 1\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n   this[offset] = (value >>> 24)\n   this[offset
+ 1] = (value >>> 16)\n   this[offset + 2] = (value >>> 8)\n   this[offset + 3] = (value & 0xff)\n } else {\n
objectWriteUInt32(this, value, offset, false)\n }\n return offset + 4\n}\n\nfunction checkIEEE754 (buf, value,
offset, ext, max, min) {\n if (offset + ext > buf.length) throw new RangeError('Index out of range')\n if (offset < 0)
throw new RangeError('Index out of range')\n}\n\nfunction writeFloat (buf, value, offset, littleEndian, noAssert) {\n
if (!noAssert) {\n   checkIEEE754(buf, value, offset, 4, 3.4028234663852886e+38, -3.4028234663852886e+38)\n
}\n   ieee754.write(buf, value, offset, littleEndian, 23, 4)\n return offset + 4\n}\n\nBuffer.prototype.writeFloatLE =
function writeFloatLE (value, offset, noAssert) {\n return writeFloat(this, value, offset, true,
noAssert)\n}\n\nBuffer.prototype.writeFloatBE = function writeFloatBE (value, offset, noAssert) {\n return
writeFloat(this, value, offset, false, noAssert)\n}\n\nfunction writeDouble (buf, value, offset, littleEndian, noAssert)
{\n if (!noAssert) {\n   checkIEEE754(buf, value, offset, 8, 1.7976931348623157E+308, -
1.7976931348623157E+308)\n }\n   ieee754.write(buf, value, offset, littleEndian, 52, 8)\n return offset +
8\n}\n\nBuffer.prototype.writeDoubleLE = function writeDoubleLE (value, offset, noAssert) {\n return
writeDouble(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeDoubleBE = function writeDoubleBE
(value, offset, noAssert) {\n return writeDouble(this, value, offset, false, noAssert)\n}\n\n// copy(targetBuffer,
targetStart=0, sourceStart=0, sourceEnd=buffer.length)\nBuffer.prototype.copy = function copy (target, targetStart,
start, end) {\n if (!start) start = 0\n if (!end && end !== 0) end = this.length\n if (targetStart >= target.length)
targetStart = target.length\n if (!targetStart) targetStart = 0\n if (end > 0 && end < start) end = start\n\n // Copy 0
bytes; we're done\n if (end === start) return 0\n if (target.length === 0 || this.length === 0) return 0\n\n // Fatal
error conditions\n if (targetStart < 0) {\n   throw new RangeError('targetStart out of bounds')\n }\n if (start < 0 ||
start >= this.length) throw new RangeError('sourceStart out of bounds')\n if (end < 0) throw new
RangeError('sourceEnd out of bounds')\n\n // Are we oob?\n if (end > this.length) end = this.length\n if
(target.length - targetStart < end - start) {\n   end = target.length - targetStart + start\n }\n\n var len = end - start\n
var i\n\n if (this === target && start < targetStart && targetStart < end) {\n   // descending copy from end\n   for (i
= len - 1; i >= 0; --i) {\n     target[i + targetStart] = this[i + start]\n   }\n } else if (len < 1000 ||
!Buffer.TYPED_ARRAY_SUPPORT) {\n   // ascending copy from start\n   for (i = 0; i < len; ++i) {\n     target[i +
targetStart] = this[i + start]\n   }\n } else {\n   Uint8Array.prototype.set.call(\n     target,\n     this.subarray(start,
start + len),\n     targetStart\n   )\n }\n\n return len\n}\n\n// Usage:\n//   buffer.fill(number[, offset[, end]])\n//
buffer.fill(buffer[, offset[, end]])\n//   buffer.fill(string[, offset[, end]][, encoding])\nBuffer.prototype.fill = function
fill (val, start, end, encoding) {\n // Handle string cases:\n if (typeof val === 'string') {\n   if (typeof start ===
'string') {\n     encoding = start\n     start = 0\n     end = this.length\n   } else if (typeof end === 'string') {\n
encoding = end\n     end = this.length\n   }\n   if (val.length === 1) {\n     var code = val.charCodeAt(0)\n     if
(code < 256) {\n       val = code\n     }\n   }\n   if (encoding !== undefined && typeof encoding !== 'string') {\n
throw new TypeError('encoding must be a string')\n   }\n   if (typeof encoding === 'string' &&
!Buffer.isEncoding(encoding)) {\n     throw new TypeError('Unknown encoding: ' + encoding)\n   }\n } else if
(typeof val === 'number') {\n   val = val & 255\n }\n\n // Invalid ranges are not set to a default, so can range check
early.\n if (start < 0 || this.length < start || this.length < end) {\n   throw new RangeError('Out of range index')\n
}\n\n if (end <= start) {\n   return this\n }\n\n start = start >>> 0\n end = end === undefined ? this.length : end
>>> 0\n\n if (!val) val = 0\n\n var i\n\n if (typeof val === 'number') {\n   for (i = start; i < end; ++i) {\n     this[i] =
val\n   }\n } else {\n   var bytes = Buffer.isBuffer(val) ? val : utf8ToBytes(new Buffer(val,
encoding).toString())\n   var len = bytes.length\n   for (i = 0; i < end - start; ++i) {\n     this[i + start] = bytes[i %
len]\n   }\n }\n\n return this\n}\n\n// HELPER FUNCTIONS\n// =====\n\nvar
INVALID_BASE64_RE = /^[^+\\0-9A-Za-z-_]/g\n\nfunction base64clean (str) {\n // Node strips out invalid
characters like \\n and \\t from the string, base64-js does not\n str = stringtrim(str).replace(INVALID_BASE64_RE,
'')\n // Node converts strings with length < 2 to '\\n' if (str.length < 2) return '\\n' // Node allows for non-padded

```

```

base64 strings (missing trailing ===), base64-js does not
while (str.length % 4 !== 0) {
  str = str + '='
}
return str
}
function stringtrim (str) {
  if (str.trim) return str.trim()
  return str.replace(/^\s+|\s+$/g,
'')
}
function toHex (n) {
  if (n < 16) return '0' + n.toString(16)
  return n.toString(16)
}
function utf8ToBytes (string, units) {
  units = units || Infinity
  var codePoint
  var length = string.length
  var leadSurrogate = null
  var bytes = []
  for (var i = 0; i < length; ++i) {
    codePoint = string.charCodeAt(i)
    // is surrogate component
    if (codePoint > 0xD7FF && codePoint < 0xE000) {
      // last char was a lead
      if (!leadSurrogate) {
        // no lead yet
        if (codePoint > 0xDBFF) {
          // unexpected trail
          if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)
          continue
        } else if (i + 1 === length) {
          // unpaired lead
          if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)
          continue
        }
        // valid lead
        leadSurrogate = codePoint
        continue
      }
      // 2 leads in a row
      if (codePoint < 0xDC00) {
        if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)
        leadSurrogate = codePoint
        continue
      }
      // valid surrogate pair
      codePoint = (leadSurrogate - 0xD800 << 10 | codePoint - 0xDC00) + 0x10000
    } else if (leadSurrogate) {
      // valid bmp char, but last char was a lead
      if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)
    }
    leadSurrogate = null
    // encode utf8
    if (codePoint < 0x80) {
      if ((units -= 1) < 0) break
      bytes.push(codePoint)
    } else if (codePoint < 0x800) {
      if ((units -= 2) < 0) break
      bytes.push(
        codePoint >> 0x6 | 0xC0,
        codePoint & 0x3F | 0x80
      )
    } else if (codePoint < 0x10000) {
      if ((units -= 3) < 0) break
      bytes.push(
        codePoint >> 0xC | 0xE0,
        codePoint >> 0x6 & 0x3F | 0x80,
        codePoint & 0x3F | 0x80
      )
    } else if (codePoint < 0x110000) {
      if ((units -= 4) < 0) break
      bytes.push(
        codePoint >> 0x12 | 0xF0,
        codePoint >> 0xC & 0x3F | 0x80,
        codePoint >> 0x6 & 0x3F | 0x80,
        codePoint & 0x3F | 0x80
      )
    } else {
      throw new Error('Invalid code point')
    }
  }
  return bytes
}
function asciiToBytes (str) {
  var byteArray = []
  for (var i = 0; i < str.length; ++i) {
    // Node's code seems to be doing this and not & 0x7F..
    byteArray.push(str.charCodeAt(i) & 0xFF)
  }
  return byteArray
}
function utf16leToBytes (str, units) {
  var c, hi, lo
  var byteArray = []
  for (var i = 0; i < str.length; ++i) {
    if ((units -= 2) < 0) break
    c = str.charCodeAt(i)
    hi = c >> 8
    lo = c % 256
    byteArray.push(lo)
    byteArray.push(hi)
  }
  return byteArray
}
function base64ToBytes (str) {
  return base64.toByteArray(base64clean(str))
}
function blitBuffer (src, dst, offset, length) {
  for (var i = 0; i < length; ++i) {
    if ((i + offset) >= dst.length || (i >= src.length)) break
    dst[i + offset] = src[i]
  }
  return i
}
function isnan (val) {
  return val !== val // eslint-disable-line no-self-compare
}
'/'
/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the
 * "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the
 * License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or
 * agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for
 * the specific language governing permissions and
 * limitations under the License.

```

```

=====
import {complex} from '../ops/complex';
import {tensor} from '../ops/tensor';
import {NamedTensor,
NamedTensorMap} from '../tensor_types';
import {TypedArray} from '../types';
import {sizeFromShape} from
'../util';
import {DTYPE_VALUE_SIZE_MAP, ModelArtifacts, ModelArtifactsInfo, WeightGroup,
WeightsManifestEntry} from './types';
/** Number of bytes reserved for the length of the string. (32bit integer).
const NUM_BYTES_STRING_LENGTH = 4;
**
 * Encode a map from names to weight values as an
 * ArrayBuffer, along with an
 * `Array` of `WeightsManifestEntry` as specification of the encoded weights.
 * This function does not perform sharding.
 * This function is the reverse of `decodeWeights`.
 * @param
 * tensors A map ("dict") from names to tensors.
 * @param group Group to which the weights belong (optional).
 * @returns A `Promise` of
 * - A flat `ArrayBuffer` with all the binary values of the `Tensor`s
 * concatenated.
 * - An `Array` of `WeightManifestEntry`s, carrying information including
 * tensor names,
 * `dtype`s and shapes.
 * @throws Error: on unsupported tensor `dtype`.
export async function
encodeWeights(
  tensors: NamedTensorMap|NamedTensor[], group?: WeightGroup):
  Promise<{data:
  ArrayBuffer, specs: WeightsManifestEntry[]}> {
  // TODO(adarob, cais): Support quantization.
  const specs:

```

```

WeightsManifestEntry[] = [];
const dataPromises: Array<Promise<TypedArray>> = [];
const names: string[] = Array.isArray(tensors) ? tensors.map(tensor => tensor.name) : Object.keys(tensors);
for (let i = 0; i < names.length; ++i) {
  const name = names[i];
  const t = Array.isArray(tensors) ? tensors[i].tensor : tensors[name];
  if (t.dtype !== 'float32' && t.dtype !== 'int32' && t.dtype !== 'bool' && t.dtype !== 'string' && t.dtype !== 'complex64') {
    throw new Error(`Unsupported dtype in weight '${name}': ${t.dtype}`);
  }
  const spec: WeightsManifestEntry = {name, shape: t.shape, dtype: t.dtype};
  if (t.dtype === 'string') {
    const utf8bytes = new Promise<TypedArray>(async resolve => {
      const vals = await t.bytes() as Uint8Array;
      const totalNumBytes = vals.reduce((p, c) => p + c.length, 0) + NUM_BYTES_STRING_LENGTH * vals.length;
      const bytes = new Uint8Array(totalNumBytes);
      let offset = 0;
      for (let i = 0; i < vals.length; i++) {
        const val = vals[i];
        const bytesOfLength = new Uint8Array(new Uint32Array([val.length]).buffer);
        bytes.set(bytesOfLength, offset);
        offset += NUM_BYTES_STRING_LENGTH;
        bytes.set(val, offset);
        offset += val.length;
      }
      resolve(bytes);
    });
    dataPromises.push(utf8bytes);
  } else {
    dataPromises.push(t.data());
  }
  if (group != null) {
    spec.group = group;
  }
  specs.push(spec);
}
const tensorValues = await Promise.all(dataPromises);
return {data: concatenateTypedArrays(tensorValues), specs};
}

/**
 * Decode flat ArrayBuffer as weights.
 * This function does not handle sharding.
 * This function is the reverse of `encodeWeights`.
 * @param buffer A flat ArrayBuffer carrying the binary values of the tensors
 * concatenated in the order specified in `specs`.
 * @param specs Specifications of the names, dtypes and shapes of the tensors
 * whose value are encoded by `buffer`.
 * @return A map from tensor name to tensor value, with the names corresponding
 * to names in `specs`.
 * @throws Error, if any of the tensors has unsupported dtype.
 */
export function decodeWeights(
  buffer: ArrayBuffer, specs: WeightsManifestEntry[]): NamedTensorMap {
  // TODO(adarob, cais): Support quantization.
  const out: NamedTensorMap = {};
  let float16Decode: (buffer: Uint16Array) => Float32Array | undefined;
  let offset = 0;
  for (const spec of specs) {
    const name = spec.name;
    const dtype = spec.dtype;
    const shape = spec.shape;
    const size = sizeFromShape(shape);
    let values: TypedArray|string[]|Uint8Array[];
    if ('quantization' in spec) {
      const quantization = spec.quantization;
      if (quantization.dtype === 'uint8' || quantization.dtype === 'uint16') {
        if (!('min' in quantization) && 'scale' in quantization) {
          throw new Error(`Weight ${spec.name} with quantization ${quantization.dtype} doesn't have corresponding metadata min and scale.`);
        }
      } else if (quantization.dtype === 'float16') {
        if (dtype !== 'float32') {
          throw new Error(`Weight ${spec.name} is quantized with ${quantization.dtype} which only supports weights of type float32 not ${dtype}.`);
        }
      } else {
        throw new Error(`Weight ${spec.name} has unknown quantization dtype ${quantization.dtype}. Supported quantization dtypes are: 'uint8', 'uint16', and 'float16'.`);
      }
      const quantizationSizeFactor = DTYPE_VALUE_SIZE_MAP[quantization.dtype];
      const byteBuffer = buffer.slice(offset, offset + size * quantizationSizeFactor);
      const quantizedArray = (quantization.dtype === 'uint8') ? new Uint8Array(byteBuffer) : new Uint16Array(byteBuffer);
      if (dtype === 'float32') {
        if (quantization.dtype === 'uint8' || quantization.dtype === 'uint16') {
          values = new Float32Array(quantizedArray.length);
          for (let i = 0; i < quantizedArray.length; i++) {
            const v = quantizedArray[i];
            values[i] = v * quantization.scale + quantization.min;
          }
        } else if (quantization.dtype === 'float16') {
          if (float16Decode === undefined) {
            float16Decode = getFloat16Decoder();
          }
          values = float16Decode(quantizedArray as Uint16Array);
        } else {
          throw new Error(`Unsupported quantization type ${quantization.dtype} for weight type float32.`);
        }
      } else if (dtype === 'int32') {
        if (quantization.dtype !== 'uint8' && quantization.dtype !== 'uint16') {
          throw new Error(`Unsupported quantization type ${quantization.dtype} for weight type int32.`);
        }
        values = new Int32Array(quantizedArray.length);
        for (let i = 0; i < quantizedArray.length; i++) {
          const v = quantizedArray[i];
          values[i] = Math.round(v * quantization.scale + quantization.min);
        }
      } else {
        throw new Error(`Unsupported dtype in weight '${name}': ${dtype}`);
      }
      offset += size * quantizationSizeFactor;
    } else if (dtype === 'string') {

```

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const size = sizeFromShape(spec.shape);\n    values = [];\n    for (let i = 0; i < size; i++) {\n        const byteLength
= new Uint32Array(\n            buffer.slice(offset, offset + NUM_BYTES_STRING_LENGTH))[0];\n        offset +=
NUM_BYTES_STRING_LENGTH;\n        const bytes = new Uint8Array(buffer.slice(offset, offset +
byteLength));\n        (values as Uint8Array[]).push(bytes);\n        offset += byteLength;\n    }\n } else {\n    const
dtypeFactor = DTYPE_VALUE_SIZE_MAP[dtype];\n    const byteBuffer = buffer.slice(offset, offset + size *
dtypeFactor);\n\n    if (dtype === 'float32') {\n        values = new Float32Array(byteBuffer);\n    } else if (dtype
=== 'int32') {\n        values = new Int32Array(byteBuffer);\n    } else if (dtype === 'bool') {\n        values = new
Uint8Array(byteBuffer);\n    } else if (dtype === 'complex64') {\n        values = new Float32Array(byteBuffer);\n
        const real = new Float32Array(values.length / 2);\n        const image = new Float32Array(values.length / 2);\n
        for (let i = 0; i < real.length; i++) {\n            real[i] = values[i * 2];\n            image[i] = values[i * 2 + 1];\n        }\n
        const realTensor = tensor(real, shape, 'float32');\n        const imageTensor = tensor(image, shape, 'float32');\n
        out[name] = complex(realTensor, imageTensor);\n        realTensor.dispose();\n        imageTensor.dispose();\n    }
    else {\n        throw new Error(`Unsupported dtype in weight '${name}': ${dtype}`);\n    }\n    offset += size *
dtypeFactor;\n }\n if (dtype !== 'complex64') {\n    out[name] = tensor(values, shape, dtype);\n }\n }\n }\n
return out;\n}\n\n/**\n * Concatenate TypedArrays into an ArrayBuffer.\n */\nexport function
concatenateTypedArrays(xs: TypedArray[]): ArrayBuffer {\n    // TODO(adarob, cais): Support quantization.\n    if (xs
=== null) {\n        throw new Error(`Invalid input value: ${JSON.stringify(xs)}`);\n    }\n\n    let totalByteLength = 0;\n\n
// `normalizedXs` is here for this reason: a `TypedArray`s `buffer`\n // can have a different byte length from that of
the `TypedArray` itself,\n // for example, when the `TypedArray` is created from an offset in an\n // `ArrayBuffer`.\n
`normlializedXs` holds `TypedArray`s whose `buffer`s match\n // the `TypedArray` in byte length. If an element of
`xs` does not show\n // this property, a new `TypedArray` that satisfy this property will be\n // constructed and
pushed into `normalizedXs`.\n    const normalizedXs: TypedArray[] = [];\n    xs.forEach((x: TypedArray) => {\n
        totalByteLength += x.byteLength;\n        // tslint:disable:no-any\n        normalizedXs.push(\n            x.byteLength ===
x.buffer.byteLength ? x :\n                new (x.constructor as any)(x);\n            if (!(x as any instanceof
Float32Array || x as any instanceof Int32Array ||\n                x as any instanceof Uint8Array)) {\n                throw new
Error(`Unsupported TypedArray subtype: ${x.constructor.name}`);\n            }\n            // tslint:enable:no-any\n        });\n\n
const y = new Uint8Array(totalByteLength);\n        let offset = 0;\n        normalizedXs.forEach((x: TypedArray) => {\n
            y.set(new Uint8Array(x.buffer), offset);\n            offset += x.byteLength;\n        });\n\n        return y.buffer;\n    })\n\n    // Use Buffer
on Node.js instead of Blob/atob/btoa\n    const useNodeBuffer = typeof Buffer !== 'undefined' &&\n        (typeof Blob
=== 'undefined' || typeof atob === 'undefined' ||\n            typeof btoa === 'undefined');\n\n    /**\n     * Calculate the byte
length of a JavaScript string.\n     *\n     * Note that a JavaScript string can contain wide characters, therefore the\n
     * length of the string is not necessarily equal to the byte length.\n     *\n     * @param str Input string.\n     * @returns Byte
length.\n     */\n    export function stringByteLength(str: string): number {\n        if (useNodeBuffer) {\n            return
Buffer.byteLength(str);\n        }\n        return new Blob([str]).size;\n    }\n\n    /**\n     * Encode an ArrayBuffer as a base64
encoded string.\n     *\n     * @param buffer `ArrayBuffer` to be converted.\n     * @returns A string that base64-encodes
`buffer`.\n     */\n    export function arrayBufferToBase64String(buffer: ArrayBuffer): string {\n        if (useNodeBuffer) {\n
            return Buffer.from(buffer).toString('base64');\n        }\n        const buf = new Uint8Array(buffer);\n        let s =
'';\n        for (let i = 0, l = buf.length; i < l; i++) {\n            s += String.fromCharCode(buf[i]);\n        }\n        return
btoa(s);\n    }\n\n    /**\n     * Decode a base64 string as an ArrayBuffer.\n     *\n     * @param str Base64 string.\n     * @returns Decoded `ArrayBuffer`.\n
     */\n    export function base64StringToArrayBuffer(str: string): ArrayBuffer {\n        if (useNodeBuffer) {\n            const
buf = Buffer.from(str, 'base64');\n            return buf.buffer.slice(buf.byteOffset, buf.byteOffset + buf.byteLength);\n        }\n
        const s = atob(str);\n        const buffer = new Uint8Array(s.length);\n        for (let i = 0; i < s.length; ++i) {\n
            buffer.set([s.charCodeAt(i)], i);\n        }\n        return buffer.buffer;\n    }\n\n    /**\n     * Concatenate a number of ArrayBuffers
into one.\n     *\n     * @param buffers A number of array buffers to concatenate.\n     * @returns Result of concatenating
`buffers` in order.\n     */\n    export function concatenateArrayBuffers(buffers: ArrayBuffer[]): ArrayBuffer {\n        if
(buffers.length === 1) {\n            return buffers[0];\n        }\n\n        let totalByteLength = 0;\n        buffers.forEach((buffer:
ArrayBuffer) => {\n            totalByteLength += buffer.byteLength;\n        });\n\n        const temp = new
Uint8Array(totalByteLength);\n        let offset = 0;\n        buffers.forEach((buffer: ArrayBuffer) => {\n            temp.set(new

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    Uint8Array(buffer), offset);\n    offset += buffer.byteLength;\n  });\n  return temp.buffer;\n}\n\n/**\n * Get the
basename of a path.\n *\n * Behaves in a way analogous to Linux's basename command.\n *\n * @param path\n
*/\n\nexport function basename(path: string): string {\n  const SEPARATOR = '/';\n  path = path.trim();\n  while
(path.endsWith(SEPARATOR)) {\n    path = path.slice(0, path.length - 1);\n  }\n\n  const items =
path.split(SEPARATOR);\n  return items[items.length - 1];\n}\n\n/**\n * Populate ModelArtifactsInfo fields for a
model with JSON topology.\n *\n * @param modelArtifacts\n *\n * @returns A ModelArtifactsInfo object.\n */\n\nexport
function getModelArtifactsInfoForJSON(modelArtifacts: ModelArtifacts):\n  ModelArtifactsInfo {\n  if
(modelArtifacts.modelTopology instanceof ArrayBuffer) {\n    throw new Error('Expected JSON model topology,
received ArrayBuffer.);\n  }\n\n  return {\n    dateSaved: new Date(),\n    modelTopologyType: 'JSON',\n
modelTopologyBytes: modelArtifacts.modelTopology == null ?\n      0 :\n    stringByteLength(JSON.stringify(modelArtifacts.modelTopology)),\n    weightSpecsBytes:
modelArtifacts.weightSpecs == null ?\n      0 :\n    stringByteLength(JSON.stringify(modelArtifacts.weightSpecs)),\n    weightDataBytes: modelArtifacts.weightData
== null ?\n      0 :\n    modelArtifacts.weightData.byteLength,\n  };\n}\n\n/**\n * Computes mantisa table for
casting Float16 to Float32\n *\n * See http://www.fox-toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns
Uint32Array, 2048 mantissa lookup values.\n */\n\nfunction computeFloat16MantisaTable(): Uint32Array {\n  const
convertMantissa = (i: number): number => {\n    let m = i << 13;\n    let e = 0;\n\n    while ((m & 0x00800000) ===
0) {\n      e -= 0x00800000;\n      m <<= 1;\n    }\n    m &= ~0x00800000;\n    e += 0x38800000;\n\n    return m | e;\n
};\n\n  const mantisaTable = new Uint32Array(2048);\n  mantisaTable[0] = 0;\n  for (let i = 1; i < 1024; i++) {\n
mantisaTable[i] = convertMantissa(i);\n  }\n  for (let i = 1024; i < 2048; i++) {\n    mantisaTable[i] = 0x38000000 +
((i - 1024) << 13);\n  }\n\n  return mantisaTable;\n}\n\n/**\n * Computes exponent table for casting Float16 to
Float32\n *\n * See http://www.fox-toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns Uint32Array, 64
exponent lookup values.\n */\n\nfunction computeFloat16ExponentTable(): Uint32Array {\n  const exponentTable =
new Uint32Array(64);\n  exponentTable[0] = 0;\n  exponentTable[31] = 0x47800000;\n  exponentTable[32] =
0x80000000;\n  exponentTable[63] = 0xc7800000;\n  for (let i = 1; i < 31; i++) {\n    exponentTable[i] = i << 23;\n
  }\n  for (let i = 33; i < 63; i++) {\n    exponentTable[i] = 0x80000000 + ((i - 32) << 23);\n  }\n\n  return
exponentTable;\n}\n\n/**\n * Computes offset table for casting Float16 to Float32\n *\n * See http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n *\n * @returns Uint32Array, 6d offset values.\n */\n\nfunction
computeFloat16OffsetTable(): Uint32Array {\n  const offsetTable = new Uint32Array(64);\n\n  for (let i = 0; i < 64;
i++) {\n    offsetTable[i] = 1024;\n  }\n  offsetTable[0] = offsetTable[32] = 0;\n\n  return offsetTable;\n}\n\n/**\n *
Retrieve a Float16 decoder which will decode a ByteArray of Float16 values\n * to a Float32Array.\n *\n *
@returns Function (buffer: Uint16Array) => Float32Array which decodes\n * the Uint16Array of Float16
bytes to a Float32Array.\n */\n\nexport function getFloat16Decoder(): (buffer: Uint16Array) => Float32Array {\n //
Algorithm is based off of\n // http://www.fox-toolkit.org/ftp/fasthalffloatconversion.pdf\n // Cache lookup
tables\n  const mantisaTable = computeFloat16MantisaTable();\n  const exponentTable =
computeFloat16ExponentTable();\n  const offsetTable = computeFloat16OffsetTable();\n\n  return (quantizedArray:
Uint16Array) => {\n    const buffer = new ArrayBuffer(4 * quantizedArray.length);\n    const bufferUint32View =
new Uint32Array(buffer);\n    for (let index = 0; index < quantizedArray.length; index++) {\n      const float16Bits =
quantizedArray[index];\n      const float32Bits =\n        mantisaTable[offsetTable[float16Bits >> 10]] + (float16Bits
& 0x3fff) +\n        exponentTable[float16Bits >> 10];\n      bufferUint32View[index] = float32Bits;\n    }\n    return
new Float32Array(buffer);\n  };\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====

```



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deleteRequest.onerror = error => reject(error);\n });\n\nfunction getIndexedDBFactory(): IDBFactory {\n if
(!env().getBool('IS_BROWSER')) {\n // TODO(cais): Add more info about what IOHandler subtypes are
available.\n // Maybe point to a doc page on the web and/or automatically determine\n // the available
IOHandlers and print them in the error message.\n throw new Error(\n 'Failed to obtain IndexedDB factory
because the current environment' +\n 'is not a web browser.');

```



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details.\n */\nexport class BrowserLocalStorage implements IOHandler {\n  protected readonly LS: Storage;\n  protected readonly modelPath: string;\n  protected readonly keys: LocalStorageKeys;\n\n  static readonly\n  URL_SCHEME = 'localStorage://';\n\n  constructor(modelPath: string) {\n    if (!env().getBool('IS_BROWSER') ||\n    typeof window === 'undefined' ||\n    typeof window.localStorage === 'undefined') {\n      // TODO(cais): Add\n      more info about what IOHandler subtypes are\n      // available.\n      // Maybe point to a doc page on the web\n      and/or automatically determine\n      // the available IOHandlers and print them in the error message.\n      throw\n      new Error(\n        'The current environment does not support local storage.);\n    }\n    this.LS =\n    window.localStorage;\n\n    if (modelPath == null || !modelPath) {\n      throw new Error(\n        'For local storage,\n        modelPath must not be null, undefined or empty.);\n    }\n    this.modelPath = modelPath;\n    this.keys =\n    getModelKeys(this.modelPath);\n  }\n\n  /**\n   * Save model artifacts to browser local storage.\n   *\n   * See the\n   documentation to `browserLocalStorage` for details on the saved\n   * artifacts.\n   *\n   * @param modelArtifacts\n   The model artifacts to be stored.\n   * @returns An instance of SaveResult.\n   */\n  async save(modelArtifacts:\n  ModelArtifacts): Promise<SaveResult> {\n    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n      throw new Error(\n        'BrowserLocalStorage.save() does not support saving model topology '\n        '+\n        'in binary\n        formats yet.);\n    } else {\n      const topology = JSON.stringify(modelArtifacts.modelTopology);\n      const\n      weightSpecs = JSON.stringify(modelArtifacts.weightSpecs);\n\n      const modelArtifactsInfo: ModelArtifactsInfo\n      =\n      getModelArtifactsInfoForJSON(modelArtifacts);\n\n      try {\n        this.LS.setItem(this.keys.info,\n        JSON.stringify(modelArtifactsInfo));\n        this.LS.setItem(this.keys.topology, topology);\n        this.LS.setItem(this.keys.weightSpecs, weightSpecs);\n        this.LS.setItem(\n          this.keys.weightData,\n          arrayBufferToBase64String(modelArtifacts.weightData));\n        const result: ModelArtifacts = {\n          format:\n          modelArtifacts.format,\n          generatedBy: modelArtifacts.generatedBy,\n          convertedBy:\n          modelArtifacts.convertedBy\n        };\n        if (modelArtifacts.signature != null) {\n          result.signature =\n          modelArtifacts.signature;\n        }\n        if (modelArtifacts.userDefinedMetadata != null) {\n          result.userDefinedMetadata = modelArtifacts.userDefinedMetadata;\n        }\n        if\n        (modelArtifacts.modelInitializer != null) {\n          result.modelInitializer = modelArtifacts.modelInitializer;\n        }\n        this.LS.setItem(this.keys.modelMetadata, JSON.stringify(result));\n        return {modelArtifactsInfo};\n      } catch (err) {\n        // If saving failed, clean up all items saved so far.\n        this.LS.removeItem(this.keys.info);\n        this.LS.removeItem(this.keys.topology);\n        this.LS.removeItem(this.keys.weightSpecs);\n        this.LS.removeItem(this.keys.weightData);\n        this.LS.removeItem(this.keys.modelMetadata);\n\n        throw new\n        Error(\n          `Failed to save model '${this.modelPath}' to local storage: `+\n          `size quota being exceeded is\n          a possible cause of this failure: `+\n          `modelTopologyBytes=${modelArtifactsInfo.modelTopologyBytes}, `+\n          `weightSpecsBytes=${modelArtifactsInfo.weightSpecsBytes}, `+\n          `weightDataBytes=${modelArtifactsInfo.weightDataBytes}.);\n      }\n    }\n\n    /**\n     * Load a model from\n     local storage.\n     *\n     * See the documentation to `browserLocalStorage` for details on the saved\n     * artifacts.\n     *\n     * @returns The loaded model (if loading succeeds).\n     */\n    async load(): Promise<ModelArtifacts> {\n      const info =\n      JSON.parse(this.LS.getItem(this.keys.info)) as ModelArtifactsInfo;\n      if (info == null) {\n        throw new Error(\n          `In local storage, there is no model with name '${this.modelPath}');\n        }\n        if\n        (info.modelTopologyType !== 'JSON') {\n          throw new Error(\n            'BrowserLocalStorage does not support\n            loading non-JSON model '\n            '+\n            'topology yet.);\n        }\n        const out: ModelArtifacts = {};\n\n        // Load\n        topology.\n        const topology = JSON.parse(this.LS.getItem(this.keys.topology));\n        if (topology == null) {\n          throw new Error(\n            `In local storage, the topology of model '${this.modelPath}' `+\n            `is missing.);\n        }\n        out.modelTopology = topology;\n\n        // Load weight specs.\n        const weightSpecs =\n        JSON.parse(this.LS.getItem(this.keys.weightSpecs));\n        if (weightSpecs == null) {\n          throw new Error(\n            `In local storage, the weight specs of model '${this.modelPath}' `+\n            `are missing.);\n        }\n        out.weightSpecs = weightSpecs;\n\n        // Load meta-data fields.\n        const metadataString =\n        this.LS.getItem(this.keys.modelMetadata);\n        if (metadataString != null) {\n          const metadata =\n          JSON.parse(metadataString) as ModelArtifacts;\n          out.format = metadata['format'];\n          out.generatedBy =\n          metadata['generatedBy'];\n          out.convertedBy = metadata['convertedBy'];\n          if (metadata['signature'] != null) {\n

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    out.signature = metadata['signature'];\n    }\n    if (metadata['userDefinedMetadata'] != null) {\n
out.userDefinedMetadata = metadata['userDefinedMetadata'];\n    }\n    if (metadata['modelInitializer'] != null) {\n
    out.modelInitializer = metadata['modelInitializer'];\n    }\n    }\n    // Load weight data.\n    const
weightDataBase64 = this.LS.getItem(this.keys.weightData);\n    if (weightDataBase64 == null) {\n    throw new
Error(\n        `In local storage, the binary weight values of model ` +\n        `${this.modelPath}` are missing.`);\n
    }\n    out.weightData = base64StringToArrayBuffer(weightDataBase64);\n    return out;\n    }\n}\n\nexport const
localStorageRouter: IORouter = (url: string|string[]) => {\n    if (!env().getBool('IS_BROWSER')) {\n    return null;\n
    } else {\n    if (!Array.isArray(url) && url.startsWith(BrowserLocalStorage.URL_SCHEME)) {\n    return
browserLocalStorage(\n        url.slice(BrowserLocalStorage.URL_SCHEME.length));\n    } else {\n    return
null;\n    }\n    }\n}\n\nIORouterRegistry.registerSaveRouter(localStorageRouter);\nIORouterRegistry.registerLoadRouter(localStor
ageRouter);\n\n/**\n * Factory function for local storage IOHandler.\n * This `IOHandler` supports both `save`
and `load`.\n *\n * For each model's saved artifacts, four items are saved to local storage.\n * -
`${PATH_SEPARATOR}/${modelPath}/info`: Contains meta-info about the\n * model, such as date saved, type
of the topology, size in bytes, etc.\n * - `${PATH_SEPARATOR}/${modelPath}/topology`: Model topology. For
Keras-\n * style models, this is a stringized JSON.\n * -
`${PATH_SEPARATOR}/${modelPath}/weight_specs`: Weight specs of the\n * model, can be used to decode
the saved binary weight values (see\n * item below).\n * -
`${PATH_SEPARATOR}/${modelPath}/weight_data`: Concatenated binary\n * weight values, stored as a
base64-encoded string.\n *\n * Saving may throw an `Error` if the total size of the artifacts exceed the\n * browser-
specific quota.\n *\n * @param modelPath A unique identifier for the model to be saved. Must be a\n * non-empty
string.\n *\n * @returns An instance of `IOHandler`, which can be used with, e.g.,\n * `tf.Model.save`.\n */\nexport
function browserLocalStorage(modelPath: string): IOHandler {\n    return new
BrowserLocalStorage(modelPath);\n}\n\nexport class BrowserLocalStorageManager implements
ModelStoreManager {\n    private readonly LS: Storage;\n\n    constructor() {\n    assert(\n
env().getBool('IS_BROWSER'),\n        () => 'Current environment is not a web browser');\n    assert(\n    typeof
window === 'undefined' ||\n        typeof window.localStorage !== 'undefined',\n        () => 'Current browser does
not appear to support localStorage');\n    this.LS = window.localStorage;\n    }\n\n    async listModels():
Promise<{[path: string]: ModelArtifactsInfo}> {\n    const out: {[path: string]: ModelArtifactsInfo} = {};\n    const
prefix = PATH_PREFIX + PATH_SEPARATOR;\n    const suffix = PATH_SEPARATOR + INFO_SUFFIX;\n    for (let i = 0; i < this.LS.length; ++i) {\n    const key = this.LS.key(i);\n    if (key.startsWith(prefix) &&
key.endsWith(suffix)) {\n    const modelPath = getModelPathFromKey(key);\n    out[modelPath] =
JSON.parse(this.LS.getItem(key)) as ModelArtifactsInfo;\n    }\n    }\n    return out;\n    }\n\n    async
removeModel(path: string): Promise<ModelArtifactsInfo> {\n    path = maybeStripScheme(path);\n    const keys =
getModelKeys(path);\n    if (this.LS.getItem(keys.info) == null) {\n    throw new Error(`Cannot find model at path
`${path}``);\n    }\n    const info = JSON.parse(this.LS.getItem(keys.info)) as ModelArtifactsInfo;\n    this.LS.removeItem(keys.info);\n    this.LS.removeItem(keys.topology);\n
    this.LS.removeItem(keys.weightSpecs);\n    this.LS.removeItem(keys.weightData);\n    return info;\n    }\n}\n\n",/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n**\n * Classes and functions for model management across multiple storage mediums.\n *\n * Supported
client actions:\n * - Listing models on all registered storage mediums.\n * - Remove model by URL from any
registered storage mediums, by using URL\n * string.\n * - Moving or copying model from one path to another in

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the same medium or from\n * one medium to another, by using URL strings.\n *\n\nimport {assert} from
'./util';\n\nimport {IORouterRegistry} from './router_registry';\n\nimport {ModelArtifactsInfo, ModelStoreManager}
from './types';\n\nconst URL_SCHEME_SUFFIX = '://';\n\nexport class ModelStoreManagerRegistry {\n //
Singleton instance.\n private static instance: ModelStoreManagerRegistry;\n\n private managers: {[scheme: string]:
ModelStoreManager};\n\n private constructor() {\n this.managers = {};\n }\n\n private static getInstance():
ModelStoreManagerRegistry {\n if (ModelStoreManagerRegistry.instance == null) {\n
ModelStoreManagerRegistry.instance = new ModelStoreManagerRegistry();\n }\n return
ModelStoreManagerRegistry.instance;\n }\n\n /**\n * Register a save-handler router.\n *\n * @param
saveRouter A function that maps a URL-like string onto an instance\n * of `IOHandler` with the `save` method
defined or `null`.\n *\n * @static registerManager(scheme: string, manager: ModelStoreManager) {\n assert(scheme
!= null, () => 'scheme must not be undefined or null.');

```



```

return systemFetch;\n}\n\nexport class PlatformNode implements Platform {\n  private textEncoder: TextEncoder;\n  // tslint:disable-next-line:no-any\n  util: any;\n\n  constructor() {\n    // tslint:disable-next-line:no-require-imports\n    this.util = require('util');\n    // According to the spec, the built-in encoder can do only UTF-8 encoding.\n    // https://developer.mozilla.org/en-US/docs/Web/API/TextEncoder/TextEncoder\n    this.textEncoder = new\n    this.util.TextEncoder();\n  }\n\n  fetch(path: string, requestInits?: RequestInit): Promise<Response> {\n    if\n    (env().global.fetch != null) {\n      return env().global.fetch(path, requestInits);\n    }\n\n    if (systemFetch == null)\n    {\n      systemFetch = getNodeFetch.importFetch();\n    }\n    return systemFetch(path, requestInits);\n  }\n\n  now():\n  number {\n    const time = process.hrtime();\n    return time[0] * 1000 + time[1] / 1000000;\n  }\n\n  encode(text:\n  string, encoding: string): Uint8Array {\n    if (encoding !== 'utf-8' && encoding !== 'utf8') {\n      throw new\n      Error(\n        `Node built-in encoder only supports utf-8, but got ${encoding}`);\n    }\n    return\n    this.textEncoder.encode(text);\n  }\n\n  decode(bytes: Uint8Array, encoding: string): string {\n    if (bytes.length ===\n    0) {\n      return '';\n    }\n    return new this.util.TextDecoder(encoding).decode(bytes);\n  }\n}\n\nif\n(env().get('IS_NODE')) {\n  env().setPlatform('node', new PlatformNode());\n}\n\n"/**\n * @license\n * Copyright\n 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n */

```

```

=====
*\n\nimport {TensorBuffer} from './tensor';\nimport {DataType, DataTypeMap, Rank, ShapeMap} from\n './types';\nimport * as util from './util';\n\n/**\n * Creates an empty `tf.TensorBuffer` with the specified `shape` and\n `dtype`.\n * The values are stored in CPU as `TypedArray`. Fill the buffer using\n * `buffer.set()`, or by\n modifying directly `buffer.values`.\n * When done, call `buffer.toTensor()` to get an immutable `tf.Tensor`\n with\n * those values.\n * ```\n * // Create a buffer and set values at particular indices.\n * const buffer =\n tf.buffer([2, 2]);\n * buffer.set(3, 0, 0);\n * buffer.set(5, 1, 0);\n * // Convert the buffer back to a tensor.\n *\n buffer.toTensor().print();\n * ```\n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The dtype of the buffer. Defaults to 'float32'.\n * @param values The values of the buffer as\n `TypedArray`. Defaults to\n * zeros.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n\nexport\n function buffer<R extends Rank, D extends DataType = 'float32'>(\n  shape: ShapeMap[R], dtype: D = 'float32' as\n  D,\n  values?: DataTypeMap[D]): TensorBuffer<R, D> {\n  dtype = dtype || 'float32' as D;\n  util.assertNonNegativeIntegerDimensions(shape);\n  return new TensorBuffer<R, D>(shape, dtype,\n  values);\n}\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the\n  Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n  License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n  on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n  implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n  License.\n */

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=====
*\n\nimport {ENGINE} from './engine';\nimport {Cast, CastAttrs, CastInputs} from './kernel_names';\nimport\n {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {DataType, TensorLike} from\n './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * Casts a `tf.Tensor` to a new\n dtype.\n * ```\n * const x = tf.tensor1d([1.5, 2.5, 3]);\n * tf.cast(x, 'int32').print();\n * ```\n * @param x The\n  input tensor to be casted.\n * @param dtype The dtype to cast the input tensor to.\n * @doc {heading: 'Tensors',\n  subheading: 'Transformations'}\n */\n\nfunction cast_<T extends Tensor>(x: T|TensorLike, dtype: DataType): T {\n  const $x = convertToTensor(x, 'x', 'cast');\n  // Sanity checks.\n  if (!util.isValidDtype(dtype)) {\n    throw new

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Error(`Failed to cast to unknown dtype ${dtype}`);\n }\n if (dtype === 'string' && $x.dtype !== 'string' ||\n dtype !== 'string' && $x.dtype === 'string') {\n   throw new Error('Only strings can be casted to strings');\n }\n\n const inputs: CastInputs = {x: $x};\n const attrs: CastAttrs = {dtype};\n\n return ENGINE.runKernel(\n   Cast,\n   inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n\n\nexport const cast = op({cast_});\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Identity, IdentityInputs} from './kernel_names';\nimport\n {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n\n**\n * Creates a\n new tensor with the same values and shape as the specified\n * tensor.\n *`js\n * const x = tf.tensor([1, 2]);\n *\n * x.clone().print();\n *``\n * @param x The tensor to clone.\n *`n\n * @doc {heading: 'Tensors', subheading:\n 'Creation'}\n\n*\n\nfunction clone_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x',\n 'clone', 'string_or_numeric');\n  const inputs: IdentityInputs = {x: $x};\n\n  // Note this op is called tf.identity in\n python. Hence the kernel name used\n // here.\n  return ENGINE.runKernel(Identity, inputs as {} as\n NamedTensorMap);\n\n\n\nexport const clone = op({clone_});\n",/**\n * @license\n * Copyright 2020 Google Inc.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {Tensor} from './tensor';\n\n\n**\n * Prints information about the `tf.Tensor` including its data.\n *\n *`js\n * const verbose = true;\n * tf.tensor2d([1, 2, 3, 4], [2, 2]).print(verbose);\n *``\n * @param x The tensor to\n be printed.\n * @param verbose Whether to print verbose information about the `Tensor`,\n * including dtype and\n size.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n\n*\n\nexport function print_<T extends Tensor>(x: T,\n verbose = false): void {\n  console.log(x.toString(verbose));\n\n\n",/**\n * @license\n * Copyright 2020 Google\n Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\n// Required side effectful code for tfjs-core\n\n// Set up Engine and ENV\nimport {getOrMakeEngine} from\n './engine';\ngetOrMakeEngine();\n\n// Register backend-agnostic flags.\nimport './flags';\n\n// Register\n platforms\nimport './platforms/platform_browser';\nimport './platforms/platform_node';\n\n// Set up\n OpHandler\nimport {buffer} from './ops/buffer';\nimport {cast} from './ops/cast';\nimport {clone} from\n './ops/clone';\nimport {print} from './ops/print';\nimport {OpHandler, setOpHandler} from './tensor';\n\nconst\n opHandler: OpHandler = {\n  buffer,\n  cast,\n  clone,\n  print\n};\nsetOpHandler(opHandler);\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
```



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MouseEvent('click')));\n    }\n    return {modelArtifactsInfo:
getModelArtifactsInfoForJSON(modelArtifacts)};\n    }\n}\n\n\nclass BrowserFiles implements IOHandler {\n
private readonly files: File[];\n\n constructor(files: File[]) {\n    if (files == null || files.length < 1) {\n        throw new
Error(\n        `When calling browserFiles, at least 1 file is required, ` +\n        `but received ${files}`);\n    }\n
this.files = files;\n }\n\n async load(): Promise<ModelArtifacts> {\n    const jsonFile = this.files[0];\n    const
weightFiles = this.files.slice(1);\n\n    return new Promise<ModelArtifacts>((resolve, reject) => {\n        const
jsonReader = new FileReader();\n        jsonReader.onload = (event: Event) => {\n            // tslint:disable-next-line:no-
any\n            const modelJSON = JSON.parse((event.target as any).result) as ModelJSON;\n            const modelTopology
= modelJSON.modelTopology;\n            if (modelTopology == null) {\n                reject(new Error(\n
`modelTopology field is missing from file ${jsonFile.name}`));\n                return;\n            }\n            if
(weightFiles.length === 0) {\n                resolve({modelTopology});\n            }\n            const weightsManifest =
modelJSON.weightsManifest;\n            if (weightsManifest == null) {\n                reject(new Error(\n
`weightManifest field is missing from file ${jsonFile.name}`));\n                return;\n            }\n            let pathToFile:
{[path: string]: File};\n            try {\n                pathToFile =\n
this.checkManifestAndWeightFiles(weightsManifest, weightFiles);\n            } catch (err) {\n                reject(err);\n
return;\n            }\n            const weightSpecs: WeightsManifestEntry[] = [];\n            const paths: string[] = [];\n
const perFileBuffers: ArrayBuffer[] = [];\n            weightsManifest.forEach(weightsGroup => {\n
weightsGroup.paths.forEach(path => {\n                paths.push(path);\n                perFileBuffers.push(null);\n            });\n
weightSpecs.push(...weightsGroup.weights);\n            });\n            weightsManifest.forEach(weightsGroup => {\n
weightsGroup.paths.forEach(path => {\n                const weightFileReader = new FileReader();\n
weightFileReader.onload = (event: Event) => {\n                    // tslint:disable-next-line:no-any\n                    const
weightData = (event.target as any).result as ArrayBuffer;\n                    const index = paths.indexOf(path);\n
perFileBuffers[index] = weightData;\n                    if (perFileBuffers.indexOf(null) === -1) {\n                        const result:
ModelArtifacts = {\n                            modelTopology,\n                            weightSpecs,\n                            weightData:\n
concatenateArrayBuffers(perFileBuffers),\n                            format: modelJSON.format,\n                            generatedBy:\n
modelJSON.generatedBy,\n                            convertedBy: modelJSON.convertedBy\n                        };\n                        if
(modelJSON.signature != null) {\n                            result.signature = modelJSON.signature;\n                        }\n                        if
(modelJSON.userDefinedMetadata != null) {\n                            result.userDefinedMetadata =\n
modelJSON.userDefinedMetadata;\n                        }\n                        if (modelJSON.modelInitializer != null) {\n
result.modelInitializer = modelJSON.modelInitializer;\n                        }\n                        resolve(result);\n                    }\n
};\n                weightFileReader.onerror = error =>\n                    reject(`Failed to weights data from file of path
'${path}'.`);\n                weightFileReader.readAsArrayBuffer(pathToFile[path]);\n            });\n            });\n            }\n
};\n            jsonReader.onerror = error => reject(\n                `Failed to read model topology and weights manifest JSON ` +\n
`from file '${jsonFile.name}'. BrowserFiles supports loading ` +\n                `Keras-style tf.Model artifacts only.`);\n
jsonReader.readAsText(jsonFile);\n            });\n        }\n    }\n\n /**\n     * Check the compatibility between weights manifest and
weight files.\n     */\n    private checkManifestAndWeightFiles(\n        manifest: WeightsManifestConfig, files: File[]):
{[path: string]: File} {\n        const basenames: string[] = [];\n        const fileNames = files.map(file =>\n
basename(file.name));\n        const pathToFile: {[path: string]: File} = {};\n        for (const group of manifest) {\n
group.paths.forEach(path => {\n            const pathBasename = basename(path);\n            if
(basenames.indexOf(pathBasename) !== -1) {\n                throw new Error(\n                    `Duplicate file basename found in
weights manifest: ` +\n                    `${pathBasename}`);\n            }\n            basenames.push(pathBasename);\n            if
(fileNames.indexOf(pathBasename) === -1) {\n                throw new Error(\n                    `Weight file with basename
'${pathBasename}' is not provided.`);\n            } else {\n                pathToFile[path] =\n
files[fileNames.indexOf(pathBasename)];\n            }\n        });\n    }\n\n    if (basenames.length !== files.length) {\n
throw new Error(\n        `Mismatch in the number of files in weights manifest ` +\n        `(${basenames.length})\n
and the number of weight files provided ` +\n        `(${files.length}).`);\n    }\n    return pathToFile;\n
}\n}\n\nexport const browserDownloadsRouter: IORouter = (url: string|string[]) => {\n    if
(!env().getBool('IS_BROWSER')) {\n        return null;\n    } else {\n        if (!Array.isArray(url) &&

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url.startsWith(BrowserDownloads.URL_SCHEME)) {\n    return
browserDownloads(url.slice(BrowserDownloads.URL_SCHEME.length));\n } else {\n    return null;\n }\n
}\n};\n\nIORouterRegistry.registerSaveRouter(browserDownloadsRouter);\n\n/**\n * Creates an IOHandler that
triggers file downloads from the browser.\n *\n * The returned `IOHandler` instance can be used as model exporting
methods such\n * as `tf.Model.save` and supports only saving.\n *\n * ```js\n * const model = tf.sequential();\n *
model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));\n * const saveResult = await
model.save('downloads://mymodel');\n * // This will trigger downloading of two files:\n * // 'mymodel.json' and
'mymodel.weights.bin'.\n * console.log(saveResult);\n * ```\n *\n * @param fileNamePrefix Prefix name of the files
to be downloaded. For use with\n * `tf.Model`, `fileNamePrefix` should follow either of the following two\n *
formats:\n * 1. `null` or `undefined`, in which case the default file\n * names will be used:\n * - 'model.json'
for the JSON file containing the model topology and\n * weights manifest.\n * - 'model.weights.bin' for the
binary file containing the binary weight\n * values.\n * 2. A single string or an Array of a single string, as the
file name prefix.\n * For example, if `foo` is provided, the downloaded JSON\n * file and binary weights file
will be named 'foo.json' and\n * 'foo.weights.bin', respectively.\n *\n * @param config Additional configuration for
triggering downloads.\n * @returns An instance of `BrowserDownloads` `IOHandler`.\n *\n * @doc {\n * heading:
'Models',\n * subheading: 'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n */\nexport function
browserDownloads(fileNamePrefix = 'model'): IOHandler {\n    return new
BrowserDownloads(fileNamePrefix);\n}\n\n/**\n * Creates an IOHandler that loads model artifacts from user-
selected files.\n *\n * This method can be used for loading from files such as user-selected files\n * in the browser.\n
*\n * When used in conjunction with `tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-style) can be
constructed from the loaded artifacts.\n *\n * ```js\n * // Note: This code snippet won't run properly without the
actual file input\n * // elements in the HTML DOM.\n * // Suppose there are two HTML file input (<input
type="file" ...>)\n * // elements.\n * const uploadJSONInput = document.getElementById('upload-json');\n * const
uploadWeightsInput = document.getElementById('upload-weights');\n * const model = await
tf.loadLayersModel(tf.io.browserFiles([\n *   uploadJSONInput.files[0], uploadWeightsInput.files[0]]);\n * ```\n
*\n * @param files `File`s to load from. Currently, this function supports only\n * loading from files that contain
Keras-style models (i.e., `tf.Model`s), for\n * which an `Array` of `File`s is expected (in that order):\n * - A JSON
file containing the model topology and weight manifest.\n * - Optionally, One or more binary files containing the
binary weights.\n * These files must have names that match the paths in the `weightsManifest`\n * contained by
the aforementioned JSON file, or errors will be thrown\n * during loading. These weights files have the same
format as the ones\n * generated by `tensorflowjs_converter` that comes with the `tensorflowjs`\n * Python PIP
package. If no weights files are provided, only the model\n * topology will be loaded from the JSON file above.\n
*\n * @returns An instance of `Files` `IOHandler`.\n *\n * @doc {\n * heading: 'Models',\n * subheading:
'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n */\nexport function browserFiles(files: File[]): IOHandler
{\n    return new BrowserFiles(files);\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n *
=====*\n
*/\n\nimport {assert} from './util';\n\nimport {OnProgressCallback} from './types';\n\n/**\n * Monitor Promise.all
progress, fire onProgress callback function.\n *\n * @param promises Promise list going to be monitored\n *\n *
@param onProgress Callback function. Fired when a promise resolved.\n *\n * @param startFraction Optional fraction
start. Default to 0.\n *\n * @param endFraction Optional fraction end. Default to 1.\n */\nexport function
monitorPromisesProgress(\n    promises: Array<Promise<{}>>, onProgress: OnProgressCallback,\n    startFraction?: number, endFraction?: number) {\n    checkPromises(promises);\n    startFraction = startFraction ==

```

```

null ? 0 : startFraction;\n endFraction = endFraction == null ? 1 : endFraction;\n checkFraction(startFraction,
endFraction);\n let resolvedPromise = 0;\n\n const registerMonitor = (promise: Promise<{}>) => {\n
promise.then(value => {\n    const fraction = startFraction +\n        ++resolvedPromise / promises.length *
(endFraction - startFraction);\n    // pass fraction as parameter to callback function.\n    onProgress(fraction);\n
return value;\n });\n return promise;\n };\n\n function checkPromises(promises: Array<Promise<{}|void>>):
void {\n    assert(\n        promises != null && Array.isArray(promises) && promises.length > 0,\n        () =>
'promises must be a none empty array');\n }\n\n function checkFraction(startFraction: number, endFraction:
number): void {\n    assert(\n        startFraction >= 0 && startFraction <= 1,\n        () => `Progress fraction must be
in range [0, 1], but ` +\n            `got startFraction ${startFraction}`);\n    assert(\n        endFraction >= 0 &&
endFraction <= 1,\n        () => `Progress fraction must be in range [0, 1], but ` +\n            `got endFraction
${endFraction}`);\n    assert(\n        endFraction >= startFraction,\n        () => `startFraction must be no more than
endFraction, but ` +\n            `got startFraction ${startFraction} and endFraction ` +\n            `${endFraction}`);\n
}\n\n return Promise.all(promises.map(registerMonitor));\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {env} from './environment';\n\nimport {NamedTensorMap} from './tensor_types';\nimport * as util
from './util';\nimport {decodeWeights} from './io_utils';\nimport {monitorPromisesProgress} from
'/progress';\nimport {DTYPE_VALUE_SIZE_MAP, LoadOptions, WeightsManifestConfig,
WeightsManifestEntry} from './types';\n\n/**\n * Reads binary weights data from a number of URLs.\n *\n *
@param fetchURLs URLs to send the HTTP requests at, using `fetch` calls.\n * @param requestOptions
RequestInit (options) for the HTTP requests.\n * @param fetchFunc Optional overriding value for the
`window.fetch` function.\n * @param onProgress Optional, progress callback function, fired periodically\n *
before the load is completed.\n * @returns A `Promise` of an Array of `ArrayBuffer`. The Array has the same\n *
length as `fetchURLs`.\n */\nexport async function loadWeightsAsArrayBuffer(\n    fetchURLs: string[],
loadOptions?: LoadOptions): Promise<ArrayBuffer[]> {\n    if (loadOptions == null) {\n        loadOptions = {};\n    }\n\n    const fetchFunc = loadOptions.fetchFunc == null ? env().platform.fetch : \n
loadOptions.fetchFunc;\n\n    // Create the requests for all of the weights in parallel.\n    const requests =
fetchURLs.map(\n        fetchURL =>\n            fetchFunc(fetchURL, loadOptions.requestInit, {isBinary: true});\n    );\n\n    const fetchStartFraction = 0;\n    const fetchEndFraction = 0.5;\n\n    const responses = loadOptions.onProgress == null
?\n        await Promise.all(requests) : \n        await monitorPromisesProgress(\n            requests, loadOptions.onProgress,
fetchStartFraction,\n            fetchEndFraction);\n\n    const bufferPromises = responses.map(response =>
response.arrayBuffer());\n\n    const bufferStartFraction = 0.5;\n    const bufferEndFraction = 1;\n\n    const buffers =
loadOptions.onProgress == null ? \n        await Promise.all(bufferPromises) : \n        await monitorPromisesProgress(\n
            bufferPromises, loadOptions.onProgress, bufferStartFraction,\n            bufferEndFraction);\n\n    return
buffers;\n}\n\n/**\n * Reads a weights manifest JSON configuration, fetches the weights and\n * returns them as
`Tensor`s.\n *\n * @param manifest The weights manifest JSON.\n * @param filePathPrefix The path prefix for
filenames given in the manifest.\n * Defaults to the empty string.\n * @param weightNames The names of the
weights to be fetched.\n */\nexport async function loadWeights(\n    manifest: WeightsManifestConfig,
filePathPrefix = "",\n    weightNames?: string[],\n    requestInit?: RequestInit): Promise<NamedTensorMap> {\n    //
TODO(nsthorat): Groups are currently fetched atomically. If you need a\n // single weight from a group, the whole
group will be fetched. At a future\n // date, we should support fetching only the individual shards within a\n //
group that are needed to reconstruct the requested weight.\n // TODO(cais): Use `decodeWeights` for
implementation.\n\n    const fetchWeights = (fetchUrls: string[]) =>\n        loadWeightsAsArrayBuffer(fetchUrls,

```



```

nameToTensorMap =\n        decodeWeights(byteBuffer, [weightsEntry.manifestEntry]);\n        for (const name in
nameToTensorMap) {\n        weightsTensorMap[name] = nameToTensorMap[name];\n        }\n    });\n\n    bufferIndexOffset += numBuffers;\n    });\n\n    return weightsTensorMap;\n    };\n\n    "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\n/**\n * IOHandler implementations based on HTTP requests in the web browser.\n * Uses
[fetch](https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API).\n */\n\nimport {env} from
'./environment';\nimport {assert} from './util';\nimport {concatenateArrayBuffers,
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'/router_registry';\nimport {IOHandler, LoadOptions, ModelArtifacts, ModelJSON, OnProgressCallback,
SaveResult, WeightsManifestConfig, WeightsManifestEntry} from './types';\nimport {loadWeightsAsArrayBuffer}
from './weights_loader';\n\nconst OCTET_STREAM_MIME_TYPE = 'application/octet-stream';\nconst
JSON_TYPE = 'application/json';\n\nexport class HTTPRequest implements IOHandler {\n  protected readonly path:
string;\n  protected readonly requestInit: RequestInit;\n\n  private readonly fetch: Function;\n  private readonly
weightUrlConverter: (weightName: string) => Promise<string>;\n\n  readonly DEFAULT_METHOD = 'POST';\n\n  static readonly URL_SCHEME_REGEX = /^https?:\\|\\|/;\n\n  private readonly weightPathPrefix: string;\n  private
readonly onProgress: OnProgressCallback;\n\n  constructor(path: string, loadOptions?: LoadOptions) {\n    if
(loadOptions == null) {\n      loadOptions = {};\n    }\n    this.weightPathPrefix = loadOptions.weightPathPrefix;\n
this.onProgress = loadOptions.onProgress;\n    this.weightUrlConverter = loadOptions.weightUrlConverter;\n\n    if
(loadOptions.fetchFunc != null) {\n      assert(\n        typeof loadOptions.fetchFunc === 'function',\n        () =>
'Must pass a function that matches the signature of ' +\n          'fetch` (see ' +\n
'https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API)`);\n      this.fetch = loadOptions.fetchFunc;\n    }
else {\n      this.fetch = env().platform.fetch;\n    }\n\n    assert(\n      path != null && path.length > 0,\n      () =>
'URL path for http must not be null, undefined or ' +\n        'empty.);\n\n    if (Array.isArray(path)) {\n
assert(\n      path.length === 2,\n      () => 'URL paths for http must have a length of 2, ' +\n        `(actual
length is ${path.length}).`);\n    }\n    this.path = path;\n\n    if (loadOptions.requestInit != null &&\n
loadOptions.requestInit.body != null) {\n      throw new Error(\n        'requestInit is expected to have no pre-
existing body, but has one.);\n    }\n    this.requestInit = loadOptions.requestInit || {};\n\n    async
save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n      if (modelArtifacts.modelTopology instanceof
ArrayBuffer) {\n        throw new Error(\n          'BrowserHTTPRequest.save() does not support saving model topology
' +\n            'in binary formats yet.);\n      }\n\n      const init = Object.assign({method: this.DEFAULT_METHOD},
this.requestInit);\n      init.body = new FormData();\n\n      const weightsManifest: WeightsManifestConfig = [{\n
paths: ['./model.weights.bin'],\n      weights: modelArtifacts.weightSpecs,\n    }];\n      const
modelTopologyAndWeightManifest: ModelJSON = {\n        modelTopology: modelArtifacts.modelTopology,\n        format:
modelArtifacts.format,\n        generatedBy: modelArtifacts.generatedBy,\n        convertedBy:
modelArtifacts.convertedBy,\n        weightsManifest\n      }; \n      if (modelArtifacts.signature != null) {\n
modelTopologyAndWeightManifest.signature = modelArtifacts.signature;\n      }\n      if
(modelArtifacts.userDefinedMetadata != null) {\n        modelTopologyAndWeightManifest.userDefinedMetadata =\n
modelArtifacts.userDefinedMetadata;\n      }\n      if (modelArtifacts.modelInitializer != null) {\n
modelTopologyAndWeightManifest.modelInitializer =\n        modelArtifacts.modelInitializer;\n      }\n\n      init.body.append(\n        'model.json',\n        new Blob(\n
[JSON.stringify(modelTopologyAndWeightManifest)],\n          {type: JSON_TYPE}),\n        'model.json');\n\n      if
(modelArtifacts.weightData != null) {\n        init.body.append(\n          'model.weights.bin',\n          new

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Blob([modelArtifacts.weightData], {type: OCTET_STREAM_MIME_TYPE}),\n      'model.weights.bin');\n
}\n\n  const response = await this.fetch(this.path, init);\n  if (response.ok) {\n    return {\n      modelArtifactsInfo: getModelArtifactsInfoForJSON(modelArtifacts),\n      responses: [response],\n    }; \n  } else\n  {\n    throw new Error(\n      `BrowserHTTPRequest.save() failed due to HTTP response status ` +\n      `${response.status}`);\n  }\n}\n\n/**\n * Load model artifacts via HTTP request(s).\n * See the\n documentation to `tf.io.http` for details on the saved\n * artifacts.\n * @returns The loaded model artifacts (if\n loading succeeds).\n */\n async load(): Promise<ModelArtifacts> {\n  const modelConfigRequest = await\n  this.fetch(this.path, this.requestInit);\n  if (!modelConfigRequest.ok) {\n    throw new Error(\n      `Request to\n ${this.path} failed with status code ` +\n      `${modelConfigRequest.status}. Please verify this URL points to`\n +\n      `the model JSON of the model to load.`);\n  }\n  let modelConfig: ModelJSON;\n  try {\n    modelConfig = await modelConfigRequest.json();\n  } catch (e) {\n    let message = `Failed to parse model JSON\n of response from ${this.path}`;\n    // TODO(nsthorat): Remove this after some time when we're comfortable\n that\n // .pb files are mostly gone.\n if (this.path.endsWith('.pb')) {\n    message += ' Your path contains a\n .pb file extension. ' +\n      'Support for .pb models have been removed in TensorFlow.js 1.0 ' +\n      'in favor\n of .json models. You can re-convert your Python ' +\n      'TensorFlow model using the TensorFlow.js 1.0\n conversion scripts ' +\n      'or you can convert your.pb models with the `pb2json` ' +\n      'NPM script in\n the tensorflow/tfjs-converter repository.';\n  } else {\n    message += ' Please make sure the server is serving\n valid ' +\n      'JSON for this request.';\n  }\n  throw new Error(message);\n }\n  const modelTopology =\n  modelConfig.modelTopology;\n  const weightsManifest = modelConfig.weightsManifest;\n  const generatedBy =\n  modelConfig.generatedBy;\n  const convertedBy = modelConfig.convertedBy;\n  const format =\n  modelConfig.format;\n  const signature = modelConfig.signature;\n  const userDefinedMetadata =\n  modelConfig.userDefinedMetadata;\n  // We do not allow both modelTopology and weightsManifest to be\n missing.\n  if (modelTopology == null && weightsManifest == null) {\n    throw new Error(\n      `The JSON\n from HTTP path ${this.path} contains neither model`\n +\n      `topology or manifest for weights.`);\n  }\n  let\n  weightSpecs: WeightsManifestEntry[];\n  let weightData: ArrayBuffer;\n  if (weightsManifest != null) {\n    const results = await this.loadWeights(weightsManifest);\n    [weightSpecs, weightData] = results;\n  }\n  const\n  artifacts: ModelArtifacts = {\n    modelTopology,\n    weightSpecs,\n    weightData,\n    generatedBy,\n    convertedBy,\n    format\n  }; \n  if (signature != null) {\n    artifacts.signature = signature;\n  }\n  if\n  (userDefinedMetadata != null) {\n    artifacts.userDefinedMetadata = userDefinedMetadata;\n  }\n  const\n  initializer = modelConfig.modelInitializer;\n  if (initializer) {\n    artifacts.modelInitializer = initializer;\n  }\n  return artifacts;\n }\n\n private async loadWeights(weightsManifest: WeightsManifestConfig): \n Promise<[WeightsManifestEntry[], ArrayBuffer]> {\n  const weightPath = Array.isArray(this.path) ? this.path[1] :\n  this.path;\n  const [prefix, suffix] = parseUrl(weightPath);\n  const pathPrefix = this.weightPathPrefix ||\n  prefix;\n  const weightSpecs = [];\n  for (const entry of weightsManifest) {\n    weightSpecs.push(...entry.weights);\n  }\n  const fetchURLs: string[] = [];\n  const urlPromises:\n  Array<Promise<string>> = [];\n  for (const weightsGroup of weightsManifest) {\n    for (const path of\n  weightsGroup.paths) {\n      if (this.weightUrlConverter != null) {\n        urlPromises.push(this.weightUrlConverter(path));\n      } else {\n        fetchURLs.push(pathPrefix + path +\n        suffix);\n      }\n    }\n  }\n  if (this.weightUrlConverter) {\n    fetchURLs.push(...await\n  Promise.all(urlPromises));\n  }\n  const buffers = await loadWeightsAsArrayBuffer(fetchURLs, {\n  requestInit: this.requestInit,\n  fetchFunc: this.fetch,\n  onProgress: this.onProgress\n });\n  return\n  [weightSpecs, concatenateArrayBuffers(buffers)];\n }\n\n/**\n * Extract the prefix and suffix of the url, where\n the prefix is the path before\n * the last file, and suffix is the search params after the last file.\n * ```\n * const url =\n 'http://tfhub.dev/model/1/tensorflowjs_model.pb?tfjs-format=file'\n * [prefix, suffix] = parseUrl(url)\n * // prefix =\n 'http://tfhub.dev/model/1/'\n * // suffix = '?tfjs-format=file'\n * ```\n * @param url the model url to be parsed.\n */\n export function parseUrl(url: string): [string, string] {\n  const lastSlash = url.lastIndexOf('/');\n  const\n  lastSearchParam = url.lastIndexOf('?');\n  const prefix = url.substring(0, lastSlash);\n  const suffix =\n  lastSearchParam > lastSlash ? url.substring(lastSearchParam) : '';\n  return [prefix + '/', suffix];\n }\n\n export function

```



```

isHTTPSscheme(url: string): boolean {\n return url.match(HTTPRequest.URL_SCHEME_REGEX) !=
null;\n}\n\nexport const httpRouter: IORouter =\n (url: string, loadOptions?: LoadOptions) => {\n if (typeof
fetch === 'undefined' &&\n (loadOptions === null || loadOptions.fetchFunc === null)) {\n // `http` uses
`fetch` or `node-fetch`, if one wants to use it in\n // an environment that is not the browser or node they have to
setup a\n // global fetch polyfill.\n return null;\n } else {\n let isHTTP = true;\n if
(Array.isArray(url)) {\n isHTTP = url.every(urlItem => isHTTPSscheme(urlItem));\n } else {\n
isHTTP = isHTTPSscheme(url);\n }\n if (isHTTP) {\n return http(url, loadOptions);\n }\n }\n
return null;\n
};\nIORouterRegistry.registerSaveRouter(httpRouter);\nIORouterRegistry.registerLoadRouter(httpRouter);\n\n/**\n * Creates an IOHandler subtype that sends model artifacts to HTTP server.\n * An HTTP request of the
`multipart/form-data` mime type will be sent to the\n * `path` URL. The form data includes artifacts that represent
the topology\n * and/or weights of the model. In the case of Keras-style `tf.Model`, two\n * blobs (files) exist in
form-data:\n * - A JSON file consisting of `modelTopology` and `weightsManifest`.\n * - A binary weights file
consisting of the concatenated weight values.\n * These files are in the same format as the one generated by\n *
[tfjs_converter](https://js.tensorflow.org/tutorials/import-keras.html).\n *\n * The following code snippet
exemplifies the client-side code that uses this\n * function:\n *\n * ```js\n * const model = tf.sequential();\n *
model.add(\n * tf.layers.dense({units: 1, inputShape: [100], activation: 'sigmoid'}));\n *\n * const saveResult =
await model.save(tf.io.http(\n * 'http://model-server:5000/upload', {requestInit: {method: 'PUT'}}));\n *\n *
console.log(saveResult);\n * ```\n *\n * If the default `POST` method is to be used, without any custom parameters\n *
such as headers, you can simply pass an HTTP or HTTPS URL to `model.save`:\n *\n * ```js\n * const saveResult
= await model.save('http://model-server:5000/upload');\n * ```\n *\n * The following GitHub Gist\n *
https://gist.github.com/dsmilkov/1b6046fd6132d7408d5257b0976f7864\n * implements a server based on
[flask](https://github.com/pallets/flask) that\n * can receive the request. Upon receiving the model artifacts via the
request,\n * this particular server reconstructs instances of [Keras\n * Models](https://keras.io/models/model/) in
memory.\n *\n * @param path A URL path to the model.\n * Can be an absolute HTTP path (e.g.,\n *
'http://localhost:8000/model-upload') or a relative path (e.g.,\n * './model-upload').\n *\n * @param requestInit
Request configurations to be used when sending\n * HTTP request to server using `fetch`. It can contain fields
such as\n * `method`, `credentials`, `headers`, `mode`, etc. See\n * https://developer.mozilla.org/en-
US/docs/Web/API/Request/Request\n * for more information. `requestInit` must not have a body, because the\n *
body will be set by TensorFlow.js. File blobs representing the model\n * topology (filename: 'model.json') and the
weights of the model (filename:\n * 'model.weights.bin') will be appended to the body. If `requestInit` has a\n *
`body`, an Error will be thrown.\n *\n * @param loadOptions Optional configuration for the loading. It includes the\n *
following fields:\n * - weightPathPrefix Optional, this specifies the path prefix for weight\n * files, by default
this is calculated from the path param.\n * - fetchFunc Optional, custom `fetch` function. E.g., in Node.js,\n * the
`fetch` from node-fetch can be used here.\n * - onProgress Optional, progress callback function, fired
periodically\n * before the load is completed.\n *\n * @returns An instance of `IOHandler`.\n *\n * @doc {\n *
heading: 'Models',\n * subheading: 'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n *\n * }\n\nexport function
http(path: string, loadOptions?: LoadOptions): IOHandler {\n return new HTTPRequest(path,
loadOptions);\n}\n\n/**\n * Deprecated. Use `tf.io.http`.\n *\n * @param path\n *\n * @param loadOptions\n *\n * }\n\nexport
function browserHTTPRequest(\n path: string, loadOptions?: LoadOptions): IOHandler {\n return http(path,
loadOptions);\n}\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*/\n\n/**\n * IOHandlers that pass through the in-memory ModelArtifacts format.\n */\n\nimport {IOHandler,
ModelArtifacts, SaveResult, TrainingConfig, WeightsManifestEntry} from './types';\n\nclass PassthroughLoader
implements IOHandler {\n  constructor(private readonly modelArtifacts?: ModelArtifacts) {}\n\n  async load():
Promise<ModelArtifacts> {\n    return this.modelArtifacts;\n  }\n}\n\nclass PassthroughSaver implements
IOHandler {\n  constructor(\n    private readonly saveHandler:\n      (artifacts: ModelArtifacts) =>
Promise<SaveResult>) {}\n\n  async save(modelArtifacts: ModelArtifacts) {\n    return
this.saveHandler(modelArtifacts);\n  }\n}\n\n/**\n * Creates an IOHandler that loads model artifacts from
memory.\n */\n * When used in conjunction with `tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-
style) can be constructed from the loaded artifacts.\n */\n * ```js\n * const model = await
tf.loadLayersModel(tf.io.fromMemory(\n *   modelTopology, weightSpecs, weightData));\n * ```\n */\n * @param
modelArtifacts a object containing model topology (i.e., parsed from\n * the JSON format).\n * @param
weightSpecs An array of `WeightsManifestEntry` objects describing the\n * names, shapes, types, and quantization
of the weight data.\n * @param weightData A single `ArrayBuffer` containing the weight data,\n * concatenated in
the order described by the weightSpecs.\n * @param trainingConfig Model training configuration. Optional.\n */\n *
@return A passthrough `IOHandler` that simply loads the provided data.\n */\n\nexport function fromMemory(\n
modelArtifacts: {}|ModelArtifacts, weightSpecs?: WeightsManifestEntry[],\n weightData?: ArrayBuffer,
trainingConfig?: TrainingConfig): IOHandler {\n  if (arguments.length === 1) {\n    const isModelArtifacts =\n
(modelArtifacts as ModelArtifacts).modelTopology != null ||\n      (modelArtifacts as ModelArtifacts).weightSpecs
!= null;\n    if (isModelArtifacts) {\n      return new PassthroughLoader(modelArtifacts as ModelArtifacts);\n    } else
{\n      // Legacy support: with only modelTopology.\n      // TODO(cais): Remove this deprecated API.\n
console.warn(\n        'Please call tf.io.fromMemory() with only one argument. ' +\n        'The argument should be
of type ModelArtifacts. ' +\n        'The multi-argument signature of tf.io.fromMemory() has been ' +\n
'deprecated and will be removed in a future release.);\n      return new PassthroughLoader({modelTopology:\n
modelArtifacts as {}});\n    }\n  } else {\n    // Legacy support.\n    // TODO(cais): Remove this deprecated API.\n
console.warn(\n        'Please call tf.io.fromMemory() with only one argument. ' +\n        'The argument should be of
type ModelArtifacts. ' +\n        'The multi-argument signature of tf.io.fromMemory() has been ' +\n
'deprecated and will be removed in a future release.);\n    return new PassthroughLoader({\n      modelTopology: modelArtifacts
as {},\n      weightSpecs,\n      weightData,\n      trainingConfig\n    });\n  }\n}\n\n/**\n * Creates an IOHandler that
passes saved model artifacts to a callback.\n */\n * ```js\n * function handleSave(artifacts) {\n *   // ... do something
with the artifacts ...\n *   return {modelArtifactsInfo: {...}, ...};\n * }\n */\n * const saveResult =
model.save(tf.io.withSaveHandler(handleSave));\n * ```\n */\n * @param saveHandler A function that accepts a
`ModelArtifacts` and returns a\n * `SaveResult`.\n */\n\nexport function withSaveHandler(\n  saveHandler:\n
(artifacts: ModelArtifacts) =>\n  Promise<SaveResult>): IOHandler {\n  return new
PassthroughSaver(saveHandler);\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n */\n *
http://www.apache.org/licenses/LICENSE-2.0\n */\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\n// Importing local_storage and indexed_db is necessary for the routers to be\n// registered.\n\nimport
'./indexed_db';\n\nimport './local_storage';\n\nimport {browserFiles} from './browser_files';\n\nimport
{browserHTTPRequest, http, isHTTPScheme} from './http';\n\nimport {concatenateArrayBuffers, decodeWeights,
encodeWeights, getModelArtifactsInfoForJSON} from './io_utils';\n\nimport {fromMemory, withSaveHandler} from
'./passthrough';\n\nimport {getLoadHandlers, getSaveHandlers, registerLoadRouter, registerSaveRouter} from
'./router_registry';\n\nimport {IOHandler, LoadHandler, LoadOptions, ModelArtifacts, ModelArtifactsInfo,
ModelJSON, ModelStoreManager, OnProgressCallback, RequestDetails, SaveConfig, SaveHandler, SaveResult,

```

```

WeightGroup, WeightsManifestConfig, WeightsManifestEntry } from './types';\nimport {loadWeights,
weightsLoaderFactory } from './weights_loader';\n\nexport {copyModel, listModels, moveModel, removeModel}
from './model_management';\nexport {\n browserFiles,\n browserHTTPRequest,\n concatenateArrayBuffers,\n decodeWeights,\n encodeWeights,\n fromMemory,\n getLoadHandlers,\n getModelArtifactsInfoForJSON,\n getSaveHandlers,\n http,\n IOHandler,\n isHTTPScheme,\n LoadHandler,\n LoadOptions,\n loadWeights,\n ModelArtifacts,\n ModelArtifactsInfo,\n ModelJSON,\n ModelStoreManager,\n OnProgressCallback,\n registerLoadRouter,\n registerSaveRouter,\n RequestDetails,\n SaveConfig,\n SaveHandler,\n SaveResult,\n WeightGroup,\n weightsLoaderFactory,\n WeightsManifestConfig,\n WeightsManifestEntry,\n withSaveHandler\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\nimport {ENGINE} from './engine';\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
'./operation';\n\n/**\n * Computes the dot product of two matrices, A * B. These must be matrices.\n *\n * ``js\n
const a = tf.tensor2d([1, 2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * a.matMul(b).print(); // or
tf.matMul(a, b)\n *\n * @param a First matrix in dot product operation.\n * @param b Second matrix in dot
product operation.\n * @param transposeA If true, `a` is transposed before multiplication.\n * @param transposeB If
true, `b` is transposed before multiplication.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n
*\nfunction matMul_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike, transposeA = false,\n
transposeB = false): T {\n  let $a = convertToTensor(a, 'a', 'matMul');\n  let $b = convertToTensor(b, 'b',
'matMul');\n  [$a, $b] = makeTypesMatch($a, $b);\n\n  const inputs: BatchMatMulInputs = {a: $a, b: $b};\n  const
attrs: BatchMatMulAttrs = {transposeA, transposeB};\n\n  return ENGINE.runKernel(\n    BatchMatMul, inputs as
{\n    } as NamedTensorMap, attrs as {\n    } as NamedAttrMap);\n\n}\n\nexport const matMul = op({matMul_});\n"/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {OneHot, OneHotAttrs, OneHotInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Creates a one-hot `tf.Tensor`. The
locations represented by `indices` take\n * value `onValue` (defaults to 1), while all other locations take value\n *
`offValue` (defaults to 0). If `indices` is rank `R`, the output has rank\n * `R+1` with the last axis of size `depth`.\n
*\n * ``js\n * tf.oneHot(tf.tensor1d([0, 1], 'int32'), 3).print();\n *\n * @param indices `tf.Tensor` of indices
with dtype `int32`.\n * @param depth The depth of the one hot dimension.\n * @param onValue A number used to
fill in the output when the index matches\n * the location.\n * @param offValue A number used to fill in the output
when the index does\n * not match the location.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n
*\nfunction oneHot_(\n  indices: Tensor|TensorLike, depth: number, onValue = 1,\n  offValue = 0): Tensor {\n

```

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if (depth < 2) {\n  throw new Error(`Error in oneHot: depth must be >=2, but it is ${depth}`);\n }
const $indices = convertToTensor(indices, 'indices', 'oneHot', 'int32');\n\n const inputs: OneHotInputs = {indices: $indices};\n const attrs: OneHotAttrs = {depth, onValue, offValue};\n\n return ENGINE.runKernel(\n  OneHot, inputs as unknown as NamedTensorMap,\n  attrs as unknown as NamedAttrMap);\n}\n\nexport const oneHot = op({oneHot_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Transpose, TransposeAttrs, TransposeInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Transposes the `tf.Tensor`. Permutes the dimensions according to `perm`. The returned `tf.Tensor`'s dimension `i` will correspond to the input dimension `perm[i]`. If `perm` is not given, it is set to `[n-1...0]`, where `n` is the rank of the input `tf.Tensor`. Hence by default, this operation performs a regular matrix transpose on 2-D input `tf.Tensor`s.\n *\n * const a = tf.tensor2d([1, 2, 3, 4, 5, 6], [2, 3]);\n *\n * a.transpose().print(); // or\n * tf.transpose(a)\n *\n * @param x The tensor to transpose.\n * @param perm The permutation of the dimensions of a.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n */\nfunction transpose_<T extends Tensor>(x: T|TensorLike, perm?: number[]): T {\n  const $x = convertToTensor(x, 'x', 'transpose');\n  if (perm == null) {\n    perm = $x.shape.map((s, i) => i).reverse();\n  }\n  util.assert(\n    $x.rank === perm.length,\n    () => `Error in transpose: rank of input ${$x.rank} ` +\n      `must match length of perm ${perm}`);\n  perm.forEach(axis => {\n    util.assert(\n      axis >= 0 && axis < $x.rank,\n      () => `All entries in 'perm' must be between 0 and ${$x.rank - 1} ` +\n        `but got ${perm}`);\n  });\n  if ($x.rank <= 1) {\n    return $x.clone();\n  }\n  const inputs: TransposeInputs = {x: $x};\n  const attrs: TransposeAttrs = {perm};\n  return ENGINE.runKernel(\n    Transpose, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const transpose = op({transpose_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {cast} from './cast';\nimport {matMul} from './mat_mul';\nimport {oneHot} from './one_hot';\nimport {op} from './operation';\nimport {transpose} from './transpose';\n\n/**\n * Computes the confusion matrix from true labels and predicted labels.\n *\n * const labels = tf.tensor1d([0, 1, 2, 1, 0], 'int32');\n * const predictions = tf.tensor1d([0, 2, 2, 1, 0], 'int32');\n * const numClasses = 3;\n * const out = tf.math.confusionMatrix(labels, predictions, numClasses);\n * out.print();\n *\n * // Expected output matrix:\n * // [[2, 0, 0],\n * // [0, 1, 1],\n * // [0, 0, 1]]\n *\n * @param labels The target labels, assumed to be 0-based integers for the classes. The shape is `[numExamples]`, where `numExamples` is the number of examples included.\n * @param predictions The predicted classes, assumed to be 0-based integers for the classes. Must have the same shape as `labels`.\n * @param numClasses Number of all classes, as an integer. Its value must be larger than the largest element in `labels` and `predictions`.\n *

```

```

@returns The confusion matrix as a int32-type 2D tensor. The value at `row` and column `c` is the number of
times examples of actual class `r` were predicted as class `c`.
@doc {heading: 'Operations', subheading: 'Evaluation'}
export function confusionMatrix_(labels: Tensor1D|TensorLike, predictions:
Tensor1D|TensorLike, numClasses: number): Tensor2D {
  const $labels = convertToTensor(labels, 'labels',
'confusionMatrix');
  const $predictions = convertToTensor(predictions, 'predictions', 'confusionMatrix');
  util.assert(numClasses == null || numClasses > 0 && Number.isInteger(numClasses), () => `If provided,
numClasses must be a positive integer, but got ${numClasses}`);
  util.assert($labels.rank ===
1, () => `Expected the rank of labels to be 1, but got ${$labels.rank}`);
  util.assert($predictions.rank
=== 1, () => `Expected the rank of predictions to be 1, but got ${$predictions.rank}`);
  util.assert($labels.shape[0] === $predictions.shape[0], () => `Mismatch in the number of examples:
${$labels.shape[0]} vs. ${$predictions.shape[0]}`);
  util.assert($labels and $predictions should have the same
number of elements.`, () => `Labels and predictions should have the same
number of elements.`);
  util.assert(numClasses > 0 && Number.isInteger(numClasses), () =>
`numClasses is required to be a positive integer, but got ${numClasses}`);
  // TODO(cais): In the
future, if oneHot supports tensors inputs for `numClasses`, `confusionMatrix` can make `numClasses`
optional.
  const oneHotLabels = oneHot(cast($labels, 'int32'), numClasses) as Tensor2D;
  const oneHotPredictions = oneHot(cast($predictions, 'int32'), numClasses) as Tensor2D;
  const oneHotLabelsT:
Tensor2D = transpose(oneHotLabels);
  const product: Tensor2D = matMul(oneHotLabelsT, oneHotPredictions);
  return cast(product, 'int32');
}
export const confusionMatrix = op({confusionMatrix_});
"/*
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for
 * the specific language governing permissions and
 * limitations under the License.
 */
=====
 * Exports under the tf.math.* namespace.
 */
import {confusionMatrix} from
'./ops/confusion_matrix';
export {confusionMatrix};
"/*
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 * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
import {Tensor3D} from './tensor';
import {inferShape} from './tensor_util_env';
import {TensorLike3D}
from './types';
import {DataType} from './types';
import {assertNonNull} from './util';
import {makeTensor}
from './tensor_ops_util';
/**
 * Creates rank-3 `tf.Tensor` with the provided values, shape and dtype.
 * The
 * same functionality can be achieved with `tf.tensor`, but in general
 * we recommend using `tf.tensor3d` as it makes
 * the code more readable.
 * ```js
 * // Pass a nested array.
 * tf.tensor3d([[[[1], [2]], [[3], [4]]]).print();
 * ```
 * ```js
 * // Pass a flat array and specify a shape.
 * tf.tensor3d([1, 2, 3, 4], [2, 2, 1]).print();
 * ```
 * @param values The values of the tensor. Can be nested array of numbers,
 * or a flat array, or a `TypedArray`.
 * @param shape The shape of the tensor. If not provided, it is inferred from
 * `values`.
 * @param dtype The
 * data type.
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
export function tensor3d(values:
TensorLike3D, shape?: [number, number, number],
dtype?: DataType): Tensor3D {
  assertNonNull(values);
  if (shape != null && shape.length !== 3) {
    throw new Error('tensor3d() requires shape to have three numbers');
  }
  const inferredShape = inferShape(values, dtype);
  if (inferredShape.length !== 3 && inferredShape.length !==
1) {
    throw new Error(`tensor3d() requires values to be number[][][] or flat/TypedArray`);
  }
  if
(inferredShape.length === 1 && shape == null) {
    throw new Error(`tensor3d() requires shape to be

```

provided when `values` are a flat array');
 return makeTensor(values, shape, inferredShape, dtype) as
 Tensor3D;

"/**
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 Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the
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 on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.
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 * limitations under the
 License.

```

=====
*/
import {ENGINE} from '../engine';
import {FromPixels, FromPixelsAttrs, FromPixelsInputs} from
../kernel_names';
import {getKernel, NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor2D,
Tensor3D} from './tensor';
import {NamedTensorMap} from './tensor_types';
import {convertToTensor} from
../tensor_util_env';
import {PixelData, TensorLike} from './types';
import {cast} from './cast';
import {op}
from './operation';
import {tensor3d} from './tensor3d';
let fromPixels2DContext:
CanvasRenderingContext2D;
/**
 * Creates a `tf.Tensor` from an image.
 * ```js
 * const image = new
 ImageData(1, 1);
 * image.data[0] = 100;
 * image.data[1] = 150;
 * image.data[2] = 200;
 * image.data[3] =
 255;
 * tf.browser.fromPixels(image).print();
 * ```
 * @param pixels The input image to construct the
 tensor from. The
 supported image types are all 4-channel. You can also pass in an image
 object with
 following attributes:
 {data: Uint8Array; width: number; height: number}
 * @param numChannels The
 number of channels of the output tensor. A
 numChannels value less than 4 allows you to ignore channels.
 Defaults to 3 (ignores alpha channel of input image).
 * @doc {heading: 'Browser', namespace: 'browser',
 ignoreCI: true}
 */
function fromPixels_(
  pixels:
  PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|
  HTMLVideoElement|ImageBitmap,
  numChannels = 3): Tensor3D {
  // Sanity checks.
  if (numChannels > 4) {
    throw new Error('Cannot
 construct Tensor with more than 4 channels from pixels.');
```

```

(isImageData || isPixelData) {\n  vals = (pixels as PixelData | ImageData).data;\n } else if (isImage || isVideo ||
isImageBitmap) {\n  if (fromPixels2DContext == null) {\n    fromPixels2DContext =
document.createElement('canvas').getContext('2d');\n  }\n  fromPixels2DContext.canvas.width = width;\n
fromPixels2DContext.canvas.height = height;\n  fromPixels2DContext.drawImage(\n    pixels as
HTMLVideoElement, 0, 0, width, height);\n  vals = fromPixels2DContext.getImageData(0, 0, width,
height).data;\n }\n let values: Int32Array;\n if (numChannels === 4) {\n  values = new Int32Array(vals);\n } else
{\n  const numPixels = width * height;\n  values = new Int32Array(numPixels * numChannels);\n  for (let i = 0;
i < numPixels; i++) {\n    for (let channel = 0; channel < numChannels; ++channel) {\n      values[i *
numChannels + channel] = vals[i * 4 + channel];\n    }\n  }\n }\n const outShape: [number, number, number] =
[height, width, numChannels];\n return tensor3d(values, outShape, 'int32');\n}\n\n/**\n * Draws a `tf.Tensor` of
pixel values to a byte array or optionally a\n * canvas.\n * When the dtype of the input is 'float32', we assume
values in the range\n * [0-1]. Otherwise, when input is 'int32', we assume values in the range\n * [0-255].\n *
Returns a promise that resolves when the canvas has been drawn to.\n * @param img A rank-2 or rank-3 tensor.
If rank-2, draws grayscale. If\n * rank-3, must have depth of 1, 3 or 4. When depth of 1, draws\n * grayscale.
When depth of 3, we draw with the first three components of\n * the depth dimension corresponding to r, g, b and
alpha = 1. When depth of\n * 4, all four components of the depth dimension correspond to r, g, b, a.\n * @param
canvas The canvas to draw to.\n * @doc {heading: 'Browser', namespace: 'browser'}\n */\nexport async function
toPixels(\n  img: Tensor2D|Tensor3D|TensorLike,\n  canvas?: HTMLCanvasElement):
Promise<Uint8ClampedArray> {\n  let $img = convertToTensor(img, 'img', 'toPixels');\n  if (!(img instanceof
Tensor)) {\n    // Assume int32 if user passed a native array.\n    const originalImgTensor = $img;\n    $img =
cast(originalImgTensor, 'int32');\n    originalImgTensor.dispose();\n  }\n  if ($img.rank !== 2 && $img.rank !== 3)
{\n    throw new Error(\n      `toPixels only supports rank 2 or 3 tensors, got rank ${$img.rank}`);\n  }\n  const
[height, width] = $img.shape.slice(0, 2);\n  const depth = $img.rank === 2 ? 1 : $img.shape[2];\n  if (depth > 4 ||
depth === 2) {\n    throw new Error(\n      `toPixels only supports depth of size ` +\n      `1, 3 or 4 but got
${depth}`);\n  }\n  if ($img.dtype !== 'float32' && $img.dtype !== 'int32') {\n    throw new Error(\n
`Unsupported type for toPixels: ${$img.dtype}` +\n      ` Please use float32 or int32 tensors.`);\n  }\n  const data
= await $img.data();\n  const multiplier = $img.dtype === 'float32' ? 255 : 1;\n  const bytes = new
Uint8ClampedArray(width * height * 4);\n  for (let i = 0; i < height * width; ++i) {\n    const rgba = [0, 0, 0,
255];\n    for (let d = 0; d < depth; d++) {\n      const value = data[i * depth + d];\n      if ($img.dtype ===
'float32') {\n        if (value < 0 || value > 1) {\n          throw new Error(\n            `Tensor values for a float32 Tensor
must be in the ` +\n            `range [0 - 1] but encountered ${value}`);\n        }\n      } else if ($img.dtype ===
'int32') {\n        if (value < 0 || value > 255) {\n          throw new Error(\n            `Tensor values for a int32 Tensor
must be in the ` +\n            `range [0 - 255] but encountered ${value}`);\n        }\n      }\n      if (depth === 1) {\n
        rgba[0] = value * multiplier;\n        rgba[1] = value * multiplier;\n        rgba[2] = value * multiplier;\n      } else
{\n        rgba[d] = value * multiplier;\n      }\n      const j = i * 4;\n      bytes[j + 0] = Math.round(rgba[0]);\n
bytes[j + 1] = Math.round(rgba[1]);\n      bytes[j + 2] = Math.round(rgba[2]);\n      bytes[j + 3] =
Math.round(rgba[3]);\n    }\n    if (canvas != null) {\n      canvas.width = width;\n      canvas.height = height;\n      const
ctx = canvas.getContext('2d');\n      const imageData = new ImageData(bytes, width, height);\n      ctx.putImageData(imageData, 0, 0);\n    }\n    if ($img !== img) {\n      $img.dispose();\n    }\n    return bytes;\n  }\n}\n\nexport
const fromPixels = op({fromPixels_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
=====
*/\nimport {TensorInfo} from '../kernel_registry';\nimport {computeStrides, sizeFromShape} from '../util';\n\n/**\n

```



```

number,\n  normalizedAxis: number): number {\n  if (normalizedAxis <= ellipsisInsertionIndex) {\n  return
normalizedAxis;\n  }\n  return normalizedAxis - (numElidedAxes - 1);\n}\n\nfunction
getElidedAxes(numElidedAxes: number, ellipsisInsertionIndex: number) {\n  const elidedAxes = [];\n  for (let i = 0;
i < numElidedAxes; i++) {\n  elidedAxes.push(ellipsisInsertionIndex + i);\n  }\n  return elidedAxes;\n}\n\n//
Normalize the start, end and strides.\nexport function getNormalizedAxes(\n  inputShape: number[], ellipsisAxes:
number[], numInterpolatedAxes: number,\n  begin: number[], end: number[], strides: number[], beginMask:
number,\n  endMask: number,\n  ellipsisMask: number): {begin: number[], end: number[], strides: number[]} {\n
const inputRank = inputShape.length;\n  let normalizedBegin = new Array(inputRank),\n  normalizedEnd = new
Array(inputRank),\n  normalizedStrides = new Array(inputRank);\n  if (ellipsisAxes.length &&
numInterpolatedAxes > 0) {\n  const fullIndex = ellipsisAxes[0];\n  // The ellipsis applies to the masked index
as well as any dimensions\n  // that are interpolated.\n  const numElidedAxes = numInterpolatedAxes + 1;\n
normalizedBegin = startIndicesWithElidedDims(\n  beginMask, fullIndex, numElidedAxes, begin,
inputShape);\n  normalizedEnd = stopIndicesWithElidedDims(\n  endMask, fullIndex, numElidedAxes, end,
inputShape);\n  normalizedStrides =\n  stridesWithElidedDims(strides, fullIndex, numElidedAxes,
inputShape);\n  } else {\n  for (let axis = 0; axis < inputRank; axis++) {\n  normalizedBegin[axis] =
startForAxis(\n  beginMask, begin, strides, inputShape, axis, ellipsisMask);\n  normalizedEnd[axis] =\n
stopForAxis(endMask, end, strides, inputShape, axis, ellipsisMask);\n  normalizedStrides[axis] =
stridesForAxis(strides, axis, ellipsisMask);\n  }\n  }\n  return {\n  begin: normalizedBegin,\n  end:
normalizedEnd,\n  strides: normalizedStrides\n  };\n}\n\n// Creates full selection at the elided dimensions. If the
dimension matches\n// the ellipsis mask, override the current start value. Otherwise, insert.\nexport function
startIndicesWithElidedDims(\n  beginMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n
originalBegin: number[], inputShape: number[]): number[] {\n  const newIndices = [...inputShape];\n  const
elidedAxes = getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n  for (let axis = 0; axis <
newIndices.length; axis++) {\n  if (elidedAxes.indexOf(axis) > -1) {\n  newIndices[axis] = 0;\n  } else {\n
const originalAxis =\n  unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n  let originalValue
= originalBegin[originalAxis];\n  if (beginMask & 1 << originalAxis) {\n  originalValue = 0;\n  }\n  newIndices[axis] = originalValue;\n  }\n  }\n  return newIndices;\n}\n\n// Creates full selection at the elided
dimensions. If the dimension matches\n// the ellipsis mask, override the current stop value. Otherwise,
insert.\nexport function stopIndicesWithElidedDims(\n  endMask: number, ellipsisInsertionIndex: number,
numElidedAxes: number,\n  originalEnd: number[], inputShape: number[]): number[] {\n  const newIndices =
[...inputShape];\n  const elidedAxes = getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n  for (let axis = 0;
axis < newIndices.length; axis++) {\n  if (elidedAxes.indexOf(axis) > -1) {\n  newIndices[axis] =
Number.MAX_SAFE_INTEGER;\n  } else {\n  const originalAxis =\n  unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n  let originalValue =
originalEnd[originalAxis];\n  if (endMask & 1 << originalAxis) {\n  originalValue =
Number.MAX_SAFE_INTEGER;\n  }\n  newIndices[axis] = originalValue;\n  }\n  }\n  for (let i = 0; i <
newIndices.length; i++) {\n  // Handle negative indices\n  const axisSize = inputShape[i];\n  if (newIndices[i] <
0) {\n  newIndices[i] += axisSize;\n  }\n  newIndices[i] = util.clamp(0, newIndices[i], inputShape[i]);\n  }\n
return newIndices;\n}\n\nexport function stridesForAxis(\n  strides: number[], axis: number, ellipsisMask:
number): number {\n  let stride = strides[axis];\n  if (ellipsisMask & (1 << axis) || stride == null) {\n  stride = 1;\n
}\n  return stride;\n}\n\nexport function startForAxis(\n  beginMask: number, startIndices: number[], strides:
number[],\n  inputShape: number[], axis: number, ellipsisMask: number): number {\n  // Begin with the specified
index\n  let start = startIndices[axis];\n  const stride = strides[axis] || 1;\n  // Check the axis bit from right of
masked axes, or the begin index is not set\n  // for the axis.\n  if (beginMask & 1 << axis || ellipsisMask & 1 << axis
|| start == null) {\n  if (stride > 0) {\n  // Forward iteration - use the first element. These values will get\n  //
clamped below (Note: We could have set them to 0 and axis_size-1, but\n  // use lowest() and max() to maintain
symmetry with StopForAxis())\n  start = Number.MIN_SAFE_INTEGER;\n  } else {\n  // Backward iteration
- use the last element.\n  start = Number.MAX_SAFE_INTEGER;\n  }\n  }\n  // Handle negative indices\n

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const axisSize = inputShape[axis];\n if (start < 0) {\n   start += axisSize;\n }\n\n // Clamping\n start =\n util.clamp(0, start, axisSize - 1);\n\n return start;\n}\n\n\nexport function stopForAxis(\n  endMask: number,\n  stopIndices: number[],\n  strides: number[],\n  inputShape: number[],\n  axis: number,\n  ellipsisMask: number): number {\n  // Begin with the specified index\n  let stop = stopIndices[axis];\n  const stride = strides[axis] || 1;\n  // Check the axis bit from right of masked axes, or if the stop index is not\n  // set for this axis.\n  if (endMask & (1 << axis) ||\n  ellipsisMask & (1 << axis) || stop === null) {\n    if (stride > 0) {\n      // Forward iteration - use the last element.\n      These values will get\n      // clamped below\n      stop = Number.MAX_SAFE_INTEGER;\n    } else {\n      // Backward iteration - use the first element.\n      stop = Number.MIN_SAFE_INTEGER;\n    }\n  }\n\n  // Handle negative indices\n  const axisSize = inputShape[axis];\n  if (stop < 0) {\n    stop += axisSize;\n  }\n\n  // Clamping\n  // Because the end index points one past the last element, we need slightly\n  // different clamping ranges depending on the direction.\n  if (stride > 0) {\n    // Forward iteration\n    stop = util.clamp(0, stop, axisSize);\n  } else {\n    // Backward iteration\n    stop = util.clamp(-1, stop, axisSize - 1);\n  }\n\n  return stop;\n}\n\n\n/**\n * Returns true if the slice occupies a continuous set of elements in the\n * 'flat' space.\n */\nexport function isSliceContinuous(\n  shape: number[],\n  begin: number[],\n  size: number[]) {\n  // Index of the first axis that has size > 1.\n  let firstNonOneAxis = size.length;\n  for (let i = 0; i < size.length; i++) {\n    if (size[i] > 1) {\n      firstNonOneAxis = i;\n      break;\n    }\n  }\n\n  for (let i = firstNonOneAxis + 1; i < size.length; i++) {\n    if (begin[i] > 0 || size[i] !== shape[i]) {\n      return false;\n    }\n  }\n\n  return true;\n}\n\n\nexport function computeFlatOffset(begin: number[], strides: number[]): number {\n  let flatOffset = begin.length > 0 ? begin[begin.length - 1] : 1;\n  for (let i = 0; i < begin.length - 1; i++) {\n    flatOffset += begin[i] * strides[i];\n  }\n\n  return flatOffset;\n}\n\n\nexport function parseSliceParams(\n  x: TensorInfo,\n  begin: number|number[],\n  size?: number|number[]) {\n  // The following logic allows for more ergonomic calls.\n  let begin_: number[];\n  const xRank = x.shape.length;\n  if (typeof begin === 'number') {\n    begin_ = [begin, ...new Array(xRank - 1).fill(0)];\n  } else if (begin.length < xRank) {\n    begin_ = begin.concat(new Array(xRank - begin.length).fill(0));\n  } else {\n    begin_ = begin.slice();\n  }\n\n  begin_.forEach(d => {\n    util.assert(\n      d !== -1, () => 'slice() does not support negative begin indexing.);\n  });\n\n  let size_: number[];\n  if (size === null) {\n    size_ = new Array(xRank).fill(-1);\n  } else if (typeof size === 'number') {\n    size_ = [size, ...new Array(xRank - 1).fill(-1)];\n  } else if (size.length < xRank) {\n    size_ = size.concat(new Array(xRank - size.length).fill(-1));\n  } else {\n    size_ = size;\n  }\n\n  size_ = size_.map((d, i) => {\n    if (d >= 0) {\n      return d;\n    } else {\n      util.assert(\n        d === -1, () => `Negative size values should be exactly -1 but got ` +\n        ` ${d} for the slice() size at index ${i}.`);\n      return x.shape[i] -\n        begin_[i];\n    }\n  });\n\n  return [begin_, size_];\n}\n\n\nexport function sliceInfo(\n  xShape: number[],\n  begin: number[],\n  end: number[],\n  strides: number[],\n  beginMask: number,\n  endMask: number,\n  ellipsisMask: number,\n  newAxisMask: number,\n  shrinkAxisMask: number): SliceInfo {\n  // make a copy because it may be modified further down.\n  let $begin = begin.slice();\n  let $end = end.slice();\n  let $strides = strides;\n\n  if (strides === null) {\n    $strides = new Array($begin.length);\n  }\n\n  const ellipsisAxes = maskToAxes(ellipsisMask);\n  if (ellipsisAxes.length > 1) {\n    throw new Error('Multiple ellipses in slice is not allowed.);\n  }\n\n  if (ellipsisMask !== 0 && newAxisMask !== 0) {\n    throw new Error(\n      'Using both ellipsisMask and newAxisMask is not yet supported.);\n  }\n\n  if (ellipsisMask !== 0 && shrinkAxisMask !== 0) {\n    throw new Error(\n      'Using both ellipsisMask and shrinkAxisMask is not yet supported.);\n  }\n\n  const numInterpolatedAxes = xShape.length -\n    $begin.length;\n\n  // Expand the dims of x based on the newAxisMask.\n  const expandAxes = maskToAxes(newAxisMask);\n  const newShape = xShape.slice();\n  expandAxes.forEach(axis => {\n    $begin[axis] = 0;\n    $end[axis] = 1;\n    newShape.splice(axis, 0, 1);\n  });\n\n  const {\n    begin: normalizedBegin,\n    end: normalizedEnd,\n    strides: normalizedStrides\n  } =\n    getNormalizedAxes(\n      newShape,\n      ellipsisAxes,\n      numInterpolatedAxes,\n      $begin,\n      $end,\n      $strides,\n      beginMask,\n      endMask,\n      ellipsisMask);\n\n  $begin = normalizedBegin;\n  $end = normalizedEnd;\n  $strides = normalizedStrides;\n\n  const shrinkAxes = maskToAxes(shrinkAxisMask);\n  // Adjust the ends based on the shrink mask.\n  shrinkAxes.forEach(axis => {\n    $end[axis] = $begin[axis] + 1;\n    $strides[axis] = 1;\n  });\n\n  // Figure out the output shape.\n  const size = computeOutShape($begin, $end, $strides);\n  // Remove the axes based on shrinkMask.\n  const outShape = size.filter((_, axis) => shrinkAxes.indexOf(axis) === -1);\n\n  const nonStrided =

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$strides.every(v => v === 1);\n\n return {nonStrided, $begin, $end, $strides, size, newShape,
outShape};\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

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=====\n
*/\n\nimport {assert} from './util';\n\n/**\n * Types to support JSON-esque data structures internally.\n *\n * Internally ConfigDict's use camelCase keys and values where the\n * values are class names to be instantiated. On
the python side, these\n * will be snake_case. Internally we allow Enums into the values for better\n * type safety,
but these need to be converted to raw primitives (usually\n * strings) for round-tripping with python.\n *\n * toConfig returns the TS-friendly representation. model.toJSON() returns\n * the pythonic version as that's the
portable format. If you need to\n * python-ify a non-model level toConfig output, you'll need to use a\n *
convertTsToPythonic from serialization_utils in -Layers.\n *\n */\n\nexport declare type ConfigDictValue =\nboolean | number | string | null | ConfigDictArray | ConfigDict;\n\nexport declare interface ConfigDict {\n [key:
string]: ConfigDictValue;\n}\n\nexport declare interface ConfigDictArray extends Array<ConfigDictValue>
{\n}\n\n/**\n * Type to represent the class-type of Serializable objects.\n *\n * Ie the class prototype with access to
the constructor and any\n * static members/methods. Instance methods are not listed here.\n *\n * Source for this
idea: https://stackoverflow.com/a/43607255\n */\n\nexport declare type SerializableConstructor<T extends
Serializable> = {\n // tslint:disable-next-line:no-any\n new (...args: any[]): T; className: string; fromConfig:
FromConfigMethod<T>;\n};\n\nexport declare type FromConfigMethod<T extends Serializable> = (\n cls:
SerializableConstructor<T>, config: ConfigDict) => T;\n\n/**\n * Serializable defines the serialization contract.\n
*\n * TFJS requires serializable classes to return their className when asked\n * to avoid issues with
minification.\n */\n\nexport abstract class Serializable {\n /**\n * Return the class name for this class to use in
serialization contexts.\n *\n * Generally speaking this will be the same thing that constructor.name\n * would
have returned. However, the class name needs to be robust\n * against minification for serialization/deserialization
to work properly.\n *\n * There's also places such as initializers.VarianceScaling, where\n * implementation
details between different languages led to different\n * class hierarchies and a non-leaf node is used for
serialization purposes.\n */\n getClassName(): string {\n return (this.constructor as
SerializableConstructor<Serializable>).className;\n }\n\n /**\n * Return all the non-weight state needed
to serialize this object.\n */\n abstract getConfig(): ConfigDict;\n\n /**\n * Creates an instance of T from a
ConfigDict.\n *\n * This works for most descendants of serializable. A few need to\n * provide special
handling.\n * @param cls A Constructor for the class to instantiate.\n * @param config The Configuration for the
object.\n */\n /** @nocollapse */\n static fromConfig<T extends Serializable>(\n cls:
SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config);\n }\n}\n\n/**\n * Maps string
keys to class constructors.\n *\n * Used during (de)serialization from the cross-language JSON format, which\n *
requires the class name in the serialization format matches the class\n * names as used in Python, should it exist.\n
*/\n\nexport class SerializationMap {\n private static instance: SerializationMap;\n private classNameMap: {\n
[className: string]:\n [SerializableConstructor<Serializable>, FromConfigMethod<Serializable>]\n };
\n\n private constructor() {\n this.classNameMap = {};\n }\n\n /**\n * Returns the singleton instance of the map.\n
*/\n static getMap(): SerializationMap {\n if (SerializationMap.instance == null) {\n
SerializationMap.instance
= new SerializationMap();\n }\n return SerializationMap.instance;\n }\n\n /**\n * Registers the class as
serializable.\n */\n static register<T extends Serializable>(cls: SerializableConstructor<T>) {\n
SerializationMap.getMap().classNameMap[cls.className] =\n [cls, cls.fromConfig];\n }\n}\n\n/**\n * Register a class with the serialization map of TensorFlow.js.\n *\n * This is often used for registering custom
Layers, so they can be\n * serialized and deserialized.\n *\n * Example:\n *\n * ```\n * class MyCustomLayer
```

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extends tf.layers.Layer {\n * static className = 'MyCustomLayer';\n *\n * constructor(config) {\n *
super(config);\n * }\n * }\n * tf.serialization.registerClass(MyCustomLayer);\n *
```\n *\n * @param cls The class
to be registered. It must have a public static member\n * called `className` defined and the value must be a non-
empty string.\n *\n * @doc {heading: 'Models', subheading: 'Serialization', ignoreCI: true}\n *
/>\n * export function
registerClass<T extends Serializable>(\n * cls: SerializableConstructor<T>) {\n * assert(\n * cls.className !=
null,\n * () => `Class being registered does not have the static className ` +\n * `property defined.`);\n *
assert(\n * typeof cls.className === 'string',\n * () => `className is required to be a string, but got type ` +\n *
typeof cls.className);\n * assert(\n * cls.className.length > 0,\n * () => `Class being registered has an empty-
string as its className, ` +\n * `which is disallowed.`);\n *
SerializationMap.register(cls);\n * }\n *
"/**\n *
@license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n *\n * import {ENGINE} from './engine';\n * import {inferShape} from './tensor_util_env';\n * import {RecursiveArray,
TensorLike, TypedArray} from './types';\n * import {arraysEqual, encodeString, flatten, isString, isTypedArray} from
 './util';\n * const TEST_EPSILON_FLOAT32 = 1e-3;\n * export const TEST_EPSILON_FLOAT16 = 1e-1;\n * export
function expectArraysClose(\n * actual: TypedArray|number|RecursiveArray<number>,\n * expected:
TypedArray|number|RecursiveArray<number>, epsilon?: number) {\n * if (epsilon == null) {\n * epsilon =
testEpsilon();\n * }\n * return expectArraysPredicate(\n * actual, expected, (a, b) => areClose(a as number, b as
number, epsilon));\n * }\n * export function testEpsilon() {\n * return ENGINE.backend.floatPrecision() === 32 ?
TEST_EPSILON_FLOAT32 :\n * TEST_EPSILON_FLOAT16;\n * }\n *
function
expectArraysPredicate(\n * actual: TensorLike, expected: TensorLike,\n * predicate: (a: {}, b: {}) => boolean) {\n *
let checkClassType = true;\n * if (isTypedArray(actual) || isTypedArray(expected)) {\n * checkClassType = false;\n *
}\n * if (isTypedArray(actual) && isTypedArray(expected)) {\n * checkClassType = true;\n * }\n * if (checkClassType)
{\n * const aType = actual.constructor.name;\n * const bType = expected.constructor.name;\n *
if (aType !== bType) {\n * throw new Error(\n * `Arrays are of different type. Actual: ${aType}. ` +\n * `Expected:
${bType}`);\n * }\n * }\n * if (Array.isArray(actual) && Array.isArray(expected)) {\n * const actualShape =
inferShape(actual);\n * const expectedShape = inferShape(expected);\n * if (!arraysEqual(actualShape,
expectedShape)) {\n * throw new Error(\n * `Arrays have different shapes. ` +\n * `Actual:
[${actualShape}]. Expected: [${expectedShape}]);\n * }\n * }\n * const actualFlat =\n * isTypedArray(actual) ?
actual : flatten(actual as RecursiveArray<number>);\n * const expectedFlat = isTypedArray(expected) ?\n *
expected :\n * flatten(expected as RecursiveArray<number>);\n * if (actualFlat.length !== expectedFlat.length)
{\n * throw new Error(\n * `Arrays have different lengths actual: ${actualFlat.length} vs ` +\n * `expected:
${expectedFlat.length}.\n * ` +\n * `Actual: ${actualFlat}.\n * ` +\n * `Expected: ${expectedFlat}.`);\n * }\n *
for (let i = 0; i < expectedFlat.length; ++i) {\n * const a = actualFlat[i];\n * const e = expectedFlat[i];\n *
if (!predicate(a, e)) {\n * throw new Error(\n * `Arrays differ: actual[${i}] = ${a}, expected[${i}] = ${e}.\n * ` +\n *
`Actual: ${actualFlat}.\n * ` +\n * `Expected: ${expectedFlat}.`);\n * }\n * }\n * }\n *
export interface DoneFn
{\n * (): void;\n * fail: (message?: Error|string) => void;\n * }\n *
export function expectPromiseToFail(fn: () =>
Promise<{}>, done: DoneFn): void {\n * fn().then(() => done.fail(), () => done());\n * }\n *
export function
expectArraysEqual(actual: TensorLike, expected: TensorLike) {\n * const exp = typeof expected === 'string' || typeof
expected === 'number' ||\n * typeof expected === 'boolean' ?\n * [expected] as number[] :\n * expected as
number[];\n * if (isString(actual) || isString((actual as string[])[0]) ||\n * isString(expected) || isString((expected as
string[])[0])) {\n * // tslint:disable-next-line: triple-equals\n * return expectArraysPredicate(actual, exp, (a, b) => a
=== b);\n * }\n * return expectArraysPredicate(\n * actual, expected, (a, b) => areClose(a as number, b as number,
0));\n * }\n *
export function expectNumbersClose(a: number, e: number, epsilon?: number) {\n * if (epsilon == null)

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{\n epsilon = testEpsilon();\n } \n if (!areClose(a, e, epsilon)) {\n throw new Error(`Numbers differ: actual ===
${a}, expected === ${e}`);\n } \n}\n\nfunction areClose(a: number, e: number, epsilon: number): boolean {\n if
(!isFinite(a) && !isFinite(e)) {\n return true;\n } \n if (isNaN(a) || isNaN(e) || Math.abs(a - e) > epsilon) {\n
return false;\n } \n return true;\n}\n\nexport function expectValuesInRange(\n actual: TypedArray|number[], low:
number, high: number) {\n for (let i = 0; i < actual.length; i++) {\n if (actual[i] < low || actual[i] > high) {\n
throw new Error(`\n `Value out of range: ${actual[i]} low: ${low}, high: ${high}`);\n } \n } \n}\n\nexport
function expectArrayBuffersEqual(\n actual: ArrayBuffer, expected: ArrayBuffer) {\n // Safari & Jasmine don't
like comparing ArrayBuffers directly. Wrapping in\n // a Float32Array solves this issue.\n expect(new
Float32Array(actual)).toEqual(new Float32Array(expected));\n}\n\n/** Encodes strings into utf-8 bytes. */\nexport
function encodeStrings(a: RecursiveArray<{}>:\n RecursiveArray<Uint8Array> {\n for (let i = 0; i < (a as
Array<{}>).length; i++) {\n const val = a[i];\n if (Array.isArray(val)) {\n encodeStrings(val);\n } else {\n
a[i] = encodeString(val as string);\n } \n } \n return a as RecursiveArray<Uint8Array>;\n}\n\n", /** @license See
the LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\nconst version = '3.1.0';\nexport
{version};\n", /** *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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===== \n
*\n\nimport {KernelBackend} from './backends/backend';\nimport {ENGINE, Engine, MemoryInfo, ProfileInfo,
ScopeFn, TimingInfo} from './engine';\nimport {env} from './environment';\nimport {Platform} from
 './platforms/platform';\nimport {setDeprecationWarningFn, Tensor} from './tensor';\nimport {TensorContainer}
from './tensor_types';\nimport {getTensorsInContainer} from './tensor_util';\n\n/**\n * Enables production mode
which disables correctness checks in favor of\n * performance.\n * \n * @doc {heading: 'Environment'}\n */\nexport
function enableProdMode(): void {\n env().set('PROD', true);\n}\n\n/**\n * Enables debug mode which will log
information about all executed kernels:\n * the elapsed time of the kernel execution, as well as the rank, shape, and\n
* size of the output tensor.\n * \n * Debug mode will significantly slow down your application as it will\n *
download the result of every operation to the CPU. This should not be used in\n * production. Debug mode does not
affect the timing information of the kernel\n * execution as we do not measure download time in the kernel
execution time.\n * \n * See also: `tf.profile`, `tf.memory`.\n * \n * @doc {heading: 'Environment'}\n */\nexport
function enableDebugMode(): void {\n env().set('DEBUG', true);\n}\n\n/** Globally disables deprecation warnings
*/\nexport function disableDeprecationWarnings(): void {\n
env().set('DEPRECATION_WARNINGS_ENABLED', false);\n console.warn(`TensorFlow.js deprecation
warnings have been disabled.`);\n}\n\n/** Warn users about deprecated functionality. */\nexport function
deprecationWarn(msg: string) {\n if (env().getBool('DEPRECATION_WARNINGS_ENABLED')) {\n
console.warn(\n msg + ' You can disable deprecation warnings with '+\n
'tf.disableDeprecationWarnings().');\n } \n}\n\nsetDeprecationWarningFn(deprecationWarn);\n\n/**\n * Dispose all
variables kept in backend engine.\n * \n * @doc {heading: 'Environment'}\n */\nexport function disposeVariables():
void {\n ENGINE.disposeVariables();\n}\n\n/**\n * It returns the global engine that keeps track of all tensors and
backends.\n * \n * @doc {heading: 'Environment'}\n */\nexport function engine(): Engine {\n return
ENGINE;\n}\n\n/**\n * Returns memory info at the current time in the program. The result is an\n * object with the
following properties:\n * \n * - `numBytes`: Number of bytes allocated (undisposed) at this time.\n * - `numTensors`:
Number of unique tensors allocated.\n * - `numDataBuffers`: Number of unique data buffers allocated\n *
(undisposed) at this time, which is the number of tensors\n * (e.g. `a.reshape(newShape)` makes a new Tensor that
shares the same\n * data buffer with `a`).\n * - `unreliable`: True if the memory usage is unreliable. See `reasons`
when\n * `unreliable` is true.\n * - `reasons`: `string[]`, reasons why the memory is unreliable, present if\n *

```

```

`unreliable` is true.\n * WebGL Properties:\n * - `numBytesInGPU`: Number of bytes allocated (undisposed) in
the GPU only at\n * this time.\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\nexport
function memory(): MemoryInfo {\n return ENGINE.memory();\n}\n\n/**\n * Executes the provided function `f()`
and returns a promise that resolves\n * with information about the function's memory use:\n * - `newBytes`: the
number of new bytes allocated\n * - `newTensors`: the number of new tensors created\n * - `peakBytes`: the peak
number of bytes allocated\n * - `kernels`: an array of objects for each kernel involved that reports\n * their input and
output shapes, number of bytes used, and number of new\n * tensors created.\n * - `kernelNames`: an array of
unique strings with just the names of the\n * kernels in the `kernels` array.\n * @js\n * const profile = await
tf.profile() => {\n * const x = tf.tensor1d([1, 2, 3]);\n * let x2 = x.square();\n * x2.dispose();\n * x2 =
x.square();\n * x2.dispose();\n * return x;\n * });\n * console.log(`newBytes: ${profile.newBytes}`);\n *
console.log(`newTensors: ${profile.newTensors}`);\n * console.log(`byte usage over all kernels:
${profile.kernels.map(k =>\n * k.totalBytesSnapshot)`);\n * @doc {heading: 'Performance',
subheading: 'Profile'}\n */\nexport function profile(f: () => (TensorContainer | Promise<TensorContainer>)):\n
Promise<ProfileInfo> {\n return ENGINE.profile(f);\n}\n\n/**\n * Executes the provided function `fn` and after it
is executed, cleans up all\n * intermediate tensors allocated by `fn` except those returned by `fn`. \n * `fn` must not
return a Promise (async functions not allowed). The returned\n * result can be a complex object.\n * Using this
method helps avoid memory leaks. In general, wrap calls to\n * operations in `tf.tidy` for automatic memory
cleanup.\n * NOTE: Variables do *not* get cleaned up when inside a tidy(). If you want to\n * dispose variables,
please use `tf.disposeVariables` or call dispose()\n * directly on variables.\n * @js\n * // y = 2 ^ 2 + 1\n * const
y = tf.tidy(() => {\n * // a, b, and one will be cleaned up when the tidy ends.\n * const one = tf.scalar(1);\n *
const a = tf.scalar(2);\n * const b = a.square();\n * console.log(`numTensors (in tidy): ` +
tf.memory().numTensors);\n * // The value returned inside the tidy function will return\n * // through the tidy,
in this case to the variable y.\n * return b.add(one);\n * });\n * console.log(`numTensors (outside tidy): ` +
tf.memory().numTensors);\n * y.print();\n * @param nameOrFn The name of the closure, or the function
to execute.\n * If a name is provided, the 2nd argument should be the function.\n * If debug mode is on, the
timing and the memory usage of the function\n * will be tracked and displayed on the console using the provided
name.\n * @param fn The function to execute.\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\n
export function tidy<T extends TensorContainer>(nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>): T {\n
return ENGINE.tidy(nameOrFn, fn);\n}\n\n/**\n * Disposes any `tf.Tensor`s found within the provided object.\n *
@param container an object that may be a `tf.Tensor` or may directly\n * contain `tf.Tensor`s, such as a
`Tensor[]` or `{key: Tensor, ...}`. If\n * the object is not a `tf.Tensor` or does not contain `Tensors`, nothing\n *
happens. In general it is safe to pass any object here, except that\n * `Promise`s are not supported.\n * @doc
{heading: 'Performance', subheading: 'Memory'}\n */\nexport function dispose(container: TensorContainer) {\n
const tensors = getTensorsInContainer(container);\n tensors.forEach(tensor => tensor.dispose());\n}\n\n/**\n *
Keeps a `tf.Tensor` generated inside a `tf.tidy` from being disposed\n * automatically.\n * @js\n * let b;\n *
const y = tf.tidy(() => {\n * const one = tf.scalar(1);\n * const a = tf.scalar(2);\n * // b will not be cleaned up
by the tidy. a and one will be cleaned up\n * // when the tidy ends.\n * b = tf.keep(a.square());\n * console.log(`numTensors (in tidy): ` +
tf.memory().numTensors);\n * // The value returned inside the tidy
function will return\n * // through the tidy, in this case to the variable y.\n * return b.add(one);\n * });\n *
console.log(`numTensors (outside tidy): ` + tf.memory().numTensors);\n * console.log(`y:`);\n * y.print();\n *
console.log(`b:`);\n * b.print();\n * @param result The tensor to keep from being disposed.\n * @doc
{heading: 'Performance', subheading: 'Memory'}\n */\nexport function keep<T extends Tensor>(result: T): T {\n
return ENGINE.keep(result);\n}\n\n/**\n * Executes `f()` and returns a promise that resolves with timing\n *
information.\n * The result is an object with the following properties:\n * - `wallMs`: Wall execution time.\n *
- `kernelMs`: Kernel execution time, ignoring data transfer. If using the\n * WebGL backend and the query timer
extension is not available, this will\n * return an error object.\n * - On `WebGL` The following additional properties
exist:\n * - `uploadWaitMs`: CPU blocking time on texture uploads.\n * - `downloadWaitMs`: CPU blocking time
on texture downloads (readPixels).\n * @js\n * const x = tf.randomNormal([20, 20]);\n * const time = await

```

```

tf.time() => x.matMul(x));\n *\n * console.log(`kernelMs: ${time.kernelMs}, wallTimeMs: ${time.wallMs}`);\n *
``\n *\n * @param f The function to execute and time.\n *\n * @doc {heading: 'Performance', subheading:
'Timing'}\n *\n * \nexport function time(f: () => void): Promise<TimingInfo> {\n return ENGINE.time(f);\n}\n\n/**\n * Sets the backend (cpu, webgl, wasm, etc) responsible for creating tensors and\n * executing operations on those
tensors. Returns a promise that resolves\n * to a boolean if the backend initialization was successful.\n *\n * Note
this disposes the current backend, if any, as well as any tensors\n * associated with it. A new backend is initialized,
even if it is of the\n * same type as the previous one.\n *\n * @param backendName The name of the backend.
Currently supports\n * `webgl|cpu` in the browser, `tensorflow` under node.js\n * (requires tfjs-node), and
`wasm` (requires tfjs-backend-wasm).\n *\n * @doc {heading: 'Backends'}\n *\n * \nexport function
setBackend(backendName: string): Promise<boolean> {\n return ENGINE.setBackend(backendName);\n}\n\n/**\n * Returns a promise that resolves when the currently selected backend (or the\n * highest priority one) has
initialized. Await this promise when you are using\n * a backend that has async initialization.\n *\n * @doc
{heading: 'Backends'}\n *\n * \nexport function ready(): Promise<void> {\n return ENGINE.ready();\n}\n\n/**\n * Returns the current backend name (cpu, webgl, etc). The backend is\n * responsible for creating tensors and
executing operations on those tensors.\n *\n * @doc {heading: 'Backends'}\n *\n * \nexport function getBackend():
string {\n return ENGINE.backendName;\n}\n\n/**\n * Removes a backend and the registered factory.\n *\n *
@doc {heading: 'Backends'}\n *\n * \nexport function removeBackend(name: string): void {\n
ENGINE.removeBackend(name);\n}\n\n/**\n * Finds the backend registered under the provided name. Returns null
if the\n * name is not in the registry, or the registration hasn't finished yet.\n *\n * \nexport function findBackend(name:
string): KernelBackend {\n return ENGINE.findBackend(name);\n}\n\n/**\n * Finds the backend factory registered
under the provided name. Returns a\n * function that produces a new backend when called. Returns null if the
name\n * is not in the registry.\n *\n * \nexport function findBackendFactory(name: string): () =>\n KernelBackend |
Promise<KernelBackend> {\n return ENGINE.findBackendFactory(name);\n}\n\n/**\n * Registers a global
backend. The registration should happen when importing\n * a module file (e.g. when importing
`backend_webgl.ts`), and is used for\n * modular builds (e.g. custom tfjs bundle with only webgl support).\n *\n *
@param factory The backend factory function. When called, it should\n * return a backend instance, or a promise of
an instance.\n *\n * @param priority The priority of the backend (higher = more important).\n * In case multiple
backends are registered, the priority is used to find\n * the best backend. Defaults to 1.\n *\n * @return False if there
is already a registered backend under this name, true\n * if not.\n *\n * @doc {heading: 'Backends'}\n *\n * \nexport
function registerBackend(\n name: string, factory: () => KernelBackend | Promise<KernelBackend>,\n priority =
1): boolean {\n return ENGINE.registerBackend(name, factory, priority);\n}\n\n/**\n * Gets the current backend. If
no backends have been initialized, this will\n * attempt to initialize the best backend. Will throw an error if the
highest\n * priority backend has async initialization, in which case, you should call\n * 'await tf.ready()' before
running other code.\n *\n * @doc {heading: 'Backends'}\n *\n * \nexport function backend(): KernelBackend {\n return
ENGINE.backend;\n}\n\n/**\n * Sets the global platform.\n *\n * @param platformName The name of this
platform.\n *\n * @param platform A platform implementation.\n *\n * \nexport function setPlatform(platformName:
string, platform: Platform) {\n env().setPlatform(platformName, platform);\n}\n\n",/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ENGINE} from '../engine';\nimport {Add, AddInputs} from '../kernel_names';\nimport {Tensor} from
'../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
'../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport
{op} from '../operation';\n\n/**\n * Adds two `tf.Tensor`s element-wise, A + B. Supports broadcasting.\n *\n *\n *

```



```

```js\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.tensor1d([10, 20, 30, 40]);\n * \n * a.add(b).print(); // or
tf.add(a, b)\n * ```\n * ```js\n * // Broadcast add a with b.\n * const a = tf.scalar(5);\n * const b = tf.tensor1d([10,
20, 30, 40]);\n * \n * a.add(b).print(); // or tf.add(a, b)\n * ```\n * @param a The first `tf.Tensor` to add.\n * @param
b The second `tf.Tensor` to add. Must have the same type as `a`.\n * @doc {heading: 'Operations', subheading:
'Arithmetic'}\n * \nfunction add_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
convertToTensor(a, 'a', 'add');\n let $b = convertToTensor(b, 'b', 'add');\n [$a, $b] = makeTypesMatch($a, $b);\n\n
const inputs: AddInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Add, inputs as { } as
NamedTensorMap);\n}\n\nexport const add = op({ add_ });\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {FloorDiv, FloorDivInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{op} from './operation';\n\n/*\n * Divides two `tf.Tensor`s element-wise, A / B. Supports broadcasting.\n * The
result is rounded with floor function.\n * \n * ```js\n * const a = tf.tensor1d([1, 4, 9, 16]);\n * const b =
tf.tensor1d([1, 2, 3, 4]);\n * \n * a.floorDiv(b).print(); // or tf.div(a, b)\n * ```\n * ```js\n * // Broadcast div a with
b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(2);\n * \n * a.floorDiv(b).print(); // or tf.floorDiv(a,
b)\n * ```\n * @param a The first tensor as the numerator.\n * @param b The second tensor as the denominator.
Must have the same dtype as `a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n * \nfunction
floorDiv_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a,
'a', 'floorDiv');\n let $b = convertToTensor(b, 'b', 'floorDiv');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const
inputs: FloorDivInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(FloorDiv, inputs as { } as
NamedTensorMap);\n}\n\nexport const floorDiv = op({ floorDiv_ });\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {RealDiv, RealDivInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{floorDiv} from './floorDiv';\nimport {op} from './operation';\n\n/*\n * Divides two `tf.Tensor`s element-wise, A /
B. Supports broadcasting.\n * \n * ```js\n * const a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n
*\n * a.div(b).print(); // or tf.div(a, b)\n * ```\n * ```js\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2,
4, 6, 8]);\n * const b = tf.scalar(2);\n * \n * a.div(b).print(); // or tf.div(a, b)\n * ```\n * @param a The first tensor
as the numerator.\n * @param b The second tensor as the denominator. Must have the same dtype as `a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n * \nfunction
div_<T extends Tensor>(a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'div');\n let $b =
convertToTensor(b, 'b', 'div');\n [$a, $b] = makeTypesMatch($a, $b);\n\n if ($a.dtype === 'int32' && $b.dtype ===
'int32') {\n return floorDiv($a, $b);\n }\n\n const inputs: RealDivInputs = {a: $a, b: $b};\n const attrs = { }; \n\n //
tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(RealDiv, inputs as { } as

```

NamedTensorMap, attrs) as T;\n\n\nexport const div = op({div_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Multiply, MultiplyInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/*\n * Multiplies two `tf.Tensor`s element-wise, A * B. Supports broadcasting.\n * We also expose `tf.mulStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the same shape (does not broadcast).\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.tensor1d([2, 3, 4, 5]);\n * a.mul(b).print(); // or tf.mul(a, b)\n * // Broadcast mul a with b.\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.scalar(5);\n * a.mul(b).print(); // or tf.mul(a, b)\n * @param a The first tensor to multiply.\n * @param b The second tensor to multiply. Must have the same dtype as `a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction mul_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'mul');\n  let $b = convertToTensor(b, 'b', 'mul');\n  [$a, $b] = makeTypesMatch($a, $b);\n  const inputs: MultiplyInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Multiply, inputs as { } as NamedTensorMap);\n}\n\nexport const mul = op({mul_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Abs, AbsInputs, ComplexAbs, ComplexAbsInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/*\n * Computes absolute value element-wise: `abs(x)`\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n * x.abs().print(); // or tf.abs(x)\n * @param x The input `tf.Tensor`.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction abs_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'abs');\n  if ($x.dtype === 'complex64') {\n    const inputs: ComplexAbsInputs = {x: $x};\n    return ENGINE.runKernel(ComplexAbs, inputs as { } as NamedTensorMap);\n  } else {\n    const inputs: AbsInputs = {x: $x};\n    return ENGINE.runKernel(Abs, inputs as { } as NamedTensorMap);\n  }\n}\n\nexport const abs = op({abs_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Acos, AcosInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
```


implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {All, AllAttrs, AllInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical and of elements across dimensions of a\n * `tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single element is returned.\n *\n * `const x = tf.tensor1d([1, 1, 1], 'bool');\n * x.all().print(); // or tf.all(x)\n *\n * `const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * const axis = 1;\n * x.all(axis).print(); // or tf.all(x, axis)\n *\n * @param x The input tensor. Must be of dtype bool.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction all_<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  const $x = convertToTensor(x, 'x', 'all', 'bool');\n  const inputs: AllInputs = {x: $x};\n  const attrs: AllAttrs = {axis, keepDims};\n  return ENGINE.runKernel(\n    All, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const all = op({all_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Any, AnyAttrs, AnyInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical or of elements across dimensions of a\n * `tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single element is returned.\n *\n * `const x = tf.tensor1d([1, 1, 1], 'bool');\n * x.any().print(); // or tf.any(x)\n *\n * `const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * const axis = 1;\n * x.any(axis).print(); // or tf.any(x, axis)\n *\n * @param x The input tensor. Must be of dtype bool.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n *\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction any_<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n  const $x = convertToTensor(x, 'x', 'any', 'bool');\n  const inputs: AnyInputs = {x: $x};\n  const attrs: AnyAttrs = {axis, keepDims};\n  return ENGINE.runKernel(\n    Any, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\n// tslint:disable-next-line:variable-name\nexport const any = op({any_});\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```


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=====\n*\n\nimport {ENGINE} from './engine';\nimport {Asinh, AsinhInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes inverse hyperbolic sin of the input `tf.Tensor` element-wise:\n * `asinh(x)`\n * \n * `js`\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * \n * x.asinh().print(); // or tf.asinh(x)\n * \n * @param x The input tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction asinh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'asinh');\n  \n  const inputs: AsinhInputs = {x: $x};\n  \n  return ENGINE.runKernel(Asinh, inputs as { } as NamedTensorMap);\n}\n\nexport const asinh = op({ asinh_ });\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Atan, AtanInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes atan of the input `tf.Tensor` element-wise: `atan(x)`\n * \n * `js`\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * \n * x.atan().print(); // or tf.atan(x)\n * \n * @param x The input tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction atan_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'atan');\n  \n  const inputs: AtanInputs = {x: $x};\n  \n  return ENGINE.runKernel(Atan, inputs as { } as NamedTensorMap);\n}\n\nexport const atan = op({ atan_ });\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {ENGINE} from './engine';\nimport {Atan2, Atan2Inputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes arctangent of `tf.Tensor`s a / b element-wise: `atan2(a, b)`\n * \n * Supports broadcasting.\n * \n * `js`\n * const a = tf.tensor1d([1.0, 1.0, -1.0, .7]);\n * const b = tf.tensor1d([2.0, 13.0, 3.5, .21]);\n * \n * tf.atan2(a, b).print()\n * \n * @param a The first tensor.\n * @param b The second tensor.\n * Must have the same dtype as `a`.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction atan2_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'atan2');\n  let $b = convertToTensor(b, 'b', 'atan2');\n  [$a, $b] = makeTypesMatch($a, $b);\n  \n  const inputs: Atan2Inputs = {a: $a, b: $b};\n  \n  return ENGINE.runKernel(Atan2, inputs as { } as NamedTensorMap);\n}\n\nexport const atan2 = op({ atan2_ });\n"/**\n * @license\n * Copyright 2018 Google
```

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=====\n*\n\nimport {ENGINE} from '../engine';\nimport {Atanh, AtanhInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Computes inverse hyperbolic tan of the input `tf.Tensor` element-wise:\n * `atanh(x)`\n * ``js\n * const x = tf.tensor1d([0, .1, -.1, .7]);\n * x.atanh().print(); // or tf.atanh(x)\n * ``\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction atanh<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'atanh');\n  const inputs: AtanhInputs = {x: $x};\n  return ENGINE.runKernel(Atanh, inputs as {} as NamedTensorMap);\n}\n\nexport const atanh = op({atanh_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\ntype PadType = 'SAME'|'VALID'|'NUMBER'|'EXPLICIT';\n\n// For NHWC should be in the following form:\n// [[0, 0], [pad_top,pad_bottom], [pad_left, pad_right], [0, 0]]\n// For NCHW should be in the following form:\n// [[0, 0], [0, 0], [pad_top,pad_bottom], [pad_left, pad_right]]\n// Reference:\n// https://www.tensorflow.org/api_docs/python/tf/nn/conv2d\n\nexport type ExplicitPadding =\n  [[number, number], [number, number], [number, number], [number, number]];\n\nexport type PadInfo = {\n  top: number,\n  left: number,\n  right: number,\n  bottom: number,\n  type: PadType\n};\n\nexport type PadInfo3D = {\n  top: number,\n  left: number,\n  right: number,\n  bottom: number,\n  front: number,\n  back: number,\n  type: PadType\n};\n\n/**\n * Information about the forward pass of a convolution/pooling operation.\n * It includes input and output shape, strides, filter size and padding\n * information.\n */\nexport type Conv2DInfo = {\n  batchSize: number,\n  inHeight: number,\n  inWidth: number,\n  inChannels: number,\n  outHeight: number,\n  outWidth: number,\n  outChannels: number,\n  dataFormat: 'channelsFirst'|'channelsLast',\n  strideHeight: number,\n  strideWidth: number,\n  dilationHeight: number,\n  dilationWidth: number,\n  filterHeight: number,\n  filterWidth: number,\n  effectiveFilterHeight: number,\n  effectiveFilterWidth: number,\n  padInfo: PadInfo,\n  inShape: [number, number, number, number],\n  outShape: [number, number, number, number],\n  filterShape: [number, number, number, number]\n};\n\n/**\n * @param inputShape Input tensor shape is of the following dimensions:\n * `[batch, height, width, inChannels]`.\n * @param filterShape The filter shape is of the following dimensions:\n * `[filterHeight, filterWidth, depth]`.\n * @param strides The strides of the sliding window for each dimension of the\n * input tensor: `[strideHeight, strideWidth]`.\n * If `strides` is a single number,\n * then `strideHeight == strideWidth`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1*1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat The data format of the input and output data.\n * Defaults to 'NHWC'.\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`.\n * Defaults to `[1, 1]`. If `dilations` is a single number, then\n * `dilationHeight == dilationWidth`.\n */\nexport function computeDilation2DInfo(\n  inputShape: [number, number, number,
```



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and padding\n * information.\n */\nexport type Conv3DInfo = {\n  batchSize: number,\n  inDepth: number,\n  inHeight: number,\n  inWidth: number,\n  inChannels: number,\n  outDepth: number,\n  outHeight: number,\n  outWidth: number,\n  outChannels: number,\n  dataFormat: 'channelsFirst'|'channelsLast',\n  strideDepth: number,\n  strideHeight: number,\n  strideWidth: number,\n  dilationDepth: number,\n  dilationHeight: number,\n  dilationWidth: number,\n  filterDepth: number,\n  filterHeight: number,\n  filterWidth: number,\n  effectiveFilterDepth: number,\n  effectiveFilterHeight: number,\n  effectiveFilterWidth: number,\n  padInfo: PadInfo3D,\n  inShape: [number, number, number, number, number],\n  outShape: [number, number, number, number, number],\n  filterShape: [number, number, number, number, number]};\n\n/**\n * Computes the information for a forward pass of a 3D convolution/pooling\n * operation.\n */\nexport function computeConv3DInfo(\n  inShape: [number, number, number, number, number],\n  filterShape: [number, number, number, number, number],\n  strides: number|[number, number, number],\n  dilations: number|[number, number, number],\n  pad: 'same'|'valid'|number,\n  depthwise = false,\n  dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast',\n  roundingMode?: 'floor'|'round'|'ceil'): Conv3DInfo {\n  let [batchSize, inDepth, inHeight, inWidth, inChannels] =\n    [-1, -1, -1, -1, -1];\n  if (dataFormat === 'channelsLast') {\n    [batchSize, inDepth, inHeight, inWidth, inChannels] = inShape;\n  } else if (dataFormat === 'channelsFirst') {\n    [batchSize, inChannels, inDepth, inHeight, inWidth] = inShape;\n  } else {\n    throw new Error(`Unknown dataFormat ${dataFormat}`);\n  }\n  const [filterDepth, filterHeight, filterWidth, , filterChannels] =\n    filterShape;\n  const [strideDepth, strideHeight, strideWidth] = parse3TupleParam(strides);\n  const [dilationDepth, dilationHeight, dilationWidth] =\n    parse3TupleParam(dilations);\n  const effectiveFilterDepth =\n    getEffectiveFilterSize(filterDepth, dilationDepth);\n  const effectiveFilterHeight =\n    getEffectiveFilterSize(filterHeight, dilationHeight);\n  const effectiveFilterWidth =\n    getEffectiveFilterSize(filterWidth, dilationWidth);\n  const {padInfo, outDepth, outHeight, outWidth} =\n    get3DPadAndOutInfo(\n      pad, inDepth, inHeight, inWidth, strideDepth, strideHeight, strideWidth,\n      effectiveFilterDepth, effectiveFilterHeight, effectiveFilterWidth,\n      roundingMode);\n  const outChannels =\n    depthwise ? filterChannels * inChannels : filterChannels;\n  let outShape: [number, number, number, number, number];\n  if (dataFormat === 'channelsFirst') {\n    outShape = [batchSize, outChannels, outDepth, outHeight, outWidth];\n  } else if (dataFormat === 'channelsLast') {\n    outShape = [batchSize, outDepth, outHeight, outWidth, outChannels];\n  }\n  return {\n    batchSize,\n    dataFormat,\n    inDepth,\n    inHeight,\n    inWidth,\n    inChannels,\n    outDepth,\n    outHeight,\n    outWidth,\n    outChannels,\n    padInfo,\n    strideDepth,\n    strideHeight,\n    strideWidth,\n    filterDepth,\n    filterHeight,\n    filterWidth,\n    effectiveFilterDepth,\n    effectiveFilterHeight,\n    effectiveFilterWidth,\n    dilationDepth,\n    dilationHeight,\n    dilationWidth,\n    inShape,\n    outShape,\n    filterShape\n  };\n}\n\nfunction computeOutputShape2D(\n  inShape: [number, number],\n  fieldSize: number,\n  stride: number,\n  zeroPad?: number,\n  roundingMode?: 'floor'|'round'|'ceil'): [number, number] {\n  if (zeroPad == null) {\n    zeroPad = computeDefaultPad(inShape, fieldSize, stride);\n  }\n  const inputRows = inShape[0];\n  const inputCols = inShape[1];\n  const outputRows =\n    round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  const outputCols =\n    round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  return [outputRows, outputCols];\n}\n\nfunction computeOutputShape4D(\n  inShape: [number, number, number, number],\n  fieldSize: number,\n  outChannels: number,\n  stride: number,\n  zeroPad?: number,\n  roundingMode?: 'floor'|'round'|'ceil'): [number, number, number, number] {\n  if (zeroPad == null) {\n    zeroPad = computeDefaultPad(inShape, fieldSize, stride);\n  }\n  const inputDepth = inShape[0];\n  const inputRows = inShape[1];\n  const inputCols = inShape[2];\n  const outputDepths =\n    round((inputDepth - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  const outputRows =\n    round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  const outputCols =\n    round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n  return [outputDepths, outputRows, outputCols, outChannels];\n}\n\nexport function computeDefaultPad(\n  inputShape: [number, number]|[number, number, number, number],\n  fieldSize: number,\n  stride: number,\n  dilation = 1): number {\n  const effectiveFieldSize =\n    getEffectiveFilterSize(fieldSize, dilation);\n  return Math.floor(\n    (inputShape[0] * (stride - 1) - stride + effectiveFieldSize) / 2);\n}\n\nfunction parseTupleParam(param: number|number[]): [number, number, number] {\n

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if (typeof param === 'number') {\n  return [param, param, param];\n } \n if (param.length === 2) {\n  return
[param[0], param[1], 1];\n } \n return param as [number, number, number];\n }\n\nfunction
parse3TupleParam(param: number|[number, number, number]):\n  [number, number, number] {\n  return typeof
param === 'number' ? [param, param, param] : param;\n }\n\n/* See
https://www.tensorflow.org/api\_docs/python/tf/nn/atrous\_conv2d\n * Atrous convolution is equivalent to standard
convolution with upsampled\n * filters with effective_filter_height =\n * filter_height + (filter_height - 1) * (dilation
- 1)\n * and effective_filter_width =\n * filter_width + (filter_width - 1) * (dilation - 1),\n * produced by inserting
dilation - 1 zeros along consecutive elements across\n * the filters' spatial dimensions.\n * When there is a dilation,
this converts a filter dimension to the\n * effective filter dimension, so it can be used in a standard convolution.\n
*\nfunction getEffectiveFilterSize(filterSize: number, dilation: number) {\n  if (dilation <= 1) {\n  return
filterSize;\n } \n\n  return filterSize + (filterSize - 1) * (dilation - 1);\n }\n\nfunction getPadAndOutInfo(\n  pad:
'same'|'valid'|number|ExplicitPadding, inHeight: number,\n  inWidth: number, strideHeight: number, strideWidth:
number,\n  filterHeight: number, filterWidth: number,\n  roundingMode: 'floor'|'round'|'ceil',\n  dataFormat:
'channelsFirst'|\n  'channelsLast'): {padInfo: PadInfo, outHeight: number, outWidth: number} {\n  let padInfo:
PadInfo;\n  let outHeight: number;\n  let outWidth: number;\n\n  if (typeof pad === 'number') {\n  const padType =
(pad === 0) ? 'VALID' : 'NUMBER';\n  padInfo = {top: pad, bottom: pad, left: pad, right: pad, type: padType};\n
const outShape = computeOutputShape2D(\n    [inHeight, inWidth], filterHeight, strideHeight, pad,\n    roundingMode);\n  outHeight = outShape[0];\n  outWidth = outShape[1];\n } else if (pad === 'same') {\n
outHeight = Math.ceil(inHeight / strideHeight);\n  outWidth = Math.ceil(inWidth / strideWidth);\n  const
padAlongHeight =\n    Math.max(0, (outHeight - 1) * strideHeight + filterHeight - inHeight);\n  const
padAlongWidth =\n    Math.max(0, (outWidth - 1) * strideWidth + filterWidth - inWidth);\n  const top =
Math.floor(padAlongHeight / 2);\n  const bottom = padAlongHeight - top;\n  const left =
Math.floor(padAlongWidth / 2);\n  const right = padAlongWidth - left;\n  padInfo = {top, bottom, left, right, type:
'SAME'};\n } else if (pad === 'valid') {\n  padInfo = {top: 0, bottom: 0, left: 0, right: 0, type: 'VALID'};\n
outHeight = Math.ceil((inHeight - filterHeight + 1) / strideHeight);\n  outWidth = Math.ceil((inWidth - filterWidth
+ 1) / strideWidth);\n } else if (typeof pad === 'object') {\n  const top = dataFormat === 'channelsLast' ? pad[1][0]
: pad[2][0];\n  const bottom = dataFormat === 'channelsLast' ? pad[1][1] : pad[2][1];\n  const left = dataFormat
=== 'channelsLast' ? pad[2][0] : pad[3][0];\n  const right = dataFormat === 'channelsLast' ? pad[2][1] :
pad[3][1];\n  const padType = (top === 0 && bottom === 0 && left === 0 && right === 0) ?\n    'VALID' :\n    'EXPLICIT';\n  padInfo = {top, bottom, left, right, type: padType};\n  outHeight = round(\n    (inHeight -
filterHeight + top + bottom) / strideHeight + 1,\n    roundingMode);\n  outWidth = round(\n    (inWidth -
filterWidth + left + right) / strideWidth + 1, roundingMode);\n } else {\n  throw Error(`Unknown padding
parameter: ${pad}`);\n } \n\n  return {padInfo, outHeight, outWidth};\n }\n\nfunction get3DPadAndOutInfo(\n  pad:
'same'|'valid'|number, inDepth: number, inHeight: number,\n  inWidth: number, strideDepth: number, strideHeight:
number,\n  strideWidth: number, filterDepth: number, filterHeight: number,\n  filterWidth: number,\n  roundingMode?: 'floor'|'round'|'ceil'): {\n  padInfo: PadInfo3D,\n  outDepth: number,\n  outHeight: number,\n
outWidth: number\n } {\n  let padInfo: PadInfo3D;\n  let outDepth: number;\n  let outHeight: number;\n  let
outWidth: number;\n\n  if (typeof pad === 'number') {\n  const padType = (pad === 0) ? 'VALID' : 'NUMBER';\n
padInfo = {\n    top: pad,\n    bottom: pad,\n    left: pad,\n    right: pad,\n    front: pad,\n    back: pad,\n
type: padType\n  };\n  const outShape = computeOutputShape4D(\n    [inDepth, inHeight, inWidth, 1],\n    filterDepth, 1, strideDepth, pad,\n    roundingMode);\n  outDepth = outShape[0];\n  outHeight = outShape[1];\n
outWidth = outShape[2];\n } else if (pad === 'same') {\n  outDepth = Math.ceil(inDepth / strideDepth);\n
outHeight = Math.ceil(inHeight / strideHeight);\n  outWidth = Math.ceil(inWidth / strideWidth);\n  const
padAlongDepth = (outDepth - 1) * strideDepth + filterDepth - inDepth;\n  const padAlongHeight =\n    (outHeight - 1) * strideHeight + filterHeight - inHeight;\n  const padAlongWidth = (outWidth - 1) * strideWidth +
filterWidth - inWidth;\n  const front = Math.floor(padAlongDepth / 2);\n  const back = padAlongDepth - front;\n
const top = Math.floor(padAlongHeight / 2);\n  const bottom = padAlongHeight - top;\n  const left =
Math.floor(padAlongWidth / 2);\n  const right = padAlongWidth - left;\n\n  padInfo = {top, bottom, left, right,

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front, back, type: 'SAME');\n } else if (pad === 'valid') {\n   padInfo = {\n     top: 0,\n     bottom: 0,\n     left: 0,\n     right: 0,\n     front: 0,\n     back: 0,\n     type: 'VALID'\n   };\n   outDepth = Math.ceil((inDepth - filterDepth + 1) / strideDepth);\n   outHeight = Math.ceil((inHeight - filterHeight + 1) / strideHeight);\n   outWidth = Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else {\n   throw Error(`Unknown padding parameter: ${pad}`);\n }\n return {padInfo, outDepth, outHeight, outWidth};\n}\n\n/**\n * Rounds a value depending on the rounding mode\n * @param value\n * @param roundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\nfunction round(value: number, roundingMode?: 'floor'|'round'|'ceil') {\n  if (!roundingMode) {\n    return Math.trunc(value);\n  }\n  switch (roundingMode) {\n    case 'round':\n      // used for Caffe Conv\n      return Math.round(value);\n    case 'ceil':\n      // used for Caffe Pool\n      return Math.ceil(value);\n    case 'floor':\n      return Math.floor(value);\n    default:\n      throw new Error(`Unknown roundingMode ${roundingMode}`);\n  }\n}\n\nexport function tupleValuesAreOne(param: number|number[]): boolean {\n  const [dimA, dimB, dimC] = parseTupleParam(param);\n  return dimA === 1 && dimB === 1 && dimC === 1;\n}\n\nexport function eitherStridesOrDilationsAreOne(\n  strides: number|number[], dilations: number|number[]): boolean {\n  return tupleValuesAreOne(strides) || tupleValuesAreOne(dilations);\n}\n\n/**\n * Convert Conv2D dataFormat from 'NHWC'|'NCHW' to\n * 'channelsLast'|'channelsFirst'\n * @param dataFormat in 'NHWC'|'NCHW' mode\n * @return dataFormat in 'channelsLast'|'channelsFirst' mode\n * @throws unknown dataFormat\n */\nexport function convertConv2DDataFormat(dataFormat: 'NHWC'|'NCHW'):\n  'channelsLast'|'channelsFirst' {\n  if (dataFormat === 'NHWC') {\n    return 'channelsLast';\n  } else if (dataFormat === 'NCHW') {\n    return 'channelsFirst';\n  } else {\n    throw new Error(`Unknown dataFormat ${dataFormat}`);\n  }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Reshape, ReshapeAttrs, ReshapeInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, ShapeMap, TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Reshapes a `tf.Tensor` to a given shape.\n * Given an input tensor, returns a new tensor with the same values as the\n * input tensor with shape `shape`.\n * If one component of shape is the special value -1, the size of that\n * dimension is computed so that the total size remains constant. In\n * particular, a shape of [-1] flattens into 1-D. At most one component\n * of shape can be -1.\n * If shape is 1-D or higher, then the operation returns a tensor with shape\n * shape filled with the values of tensor. In this case, the number of\n * elements implied by shape must be the same as the number of elements in\n * tensor.\n */\nconst x = tf.tensor1d([1, 2, 3, 4]);\n x.reshape([2, 2]).print();\n\n/**\n * @param x The input tensor to be reshaped.\n * @param shape An array of integers defining the output tensor shape.\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction reshape<R> extends Rank>(\n  x: Tensor|TensorLike, shape: ShapeMap[R]): Tensor<R> {\n  const $x = convertToTensor(x, 'x', 'reshape', 'string_or_numeric');\n  const inputs: ReshapeInputs = {x: $x};\n  const attrs: ReshapeAttrs = {shape};\n  return ENGINE.runKernel(\n    Reshape, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const reshape = op({reshape_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {cast} from\n './cast';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from\n './reshape';\n\n/**\n * Computes the 2D average pooling of an image.\n * @param x The input tensor, of rank 4\n or rank 3 of shape\n *   [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: [filterHeight, filterWidth]. If\n *   filterSize` is a single number, then `filterHeight ==\n filterWidth`. \n * @param strides The strides of the pooling: [strideHeight, strideWidth]. If\n *   strides` is a\n single number, then `strideHeight == strideWidth`. \n * @param pad The type of padding algorithm:\n *   - `same` and stride 1: output will be of same size as input,\n *   regardless of filter size.\n *   - `valid`: output will be\n smaller than input if filter is larger\n *   than 1x1.\n *   - For more info, see this guide:\n *   [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *\n https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dimRoundingMode A string from:\n 'ceil', 'round', 'floor'. If none is\n *   provided, it will default to truncate.\n */\nfunction avgPool<T> extends\n Tensor3D|Tensor4D>(\n  x: T|TensorLike, filterSize: [number, number]|number,\n  strides: [number,\n number]|number, pad: 'valid'|'same'|number,\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  const $x =\n convertToTensor(x, 'x', 'avgPool', 'float32');\n  const dilations = 1;\n  util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n    () => 'Error in avgPool: Either strides or dilations\n must be 1. ' +\n      `Got strides ${strides} and dilations ${dilations}`);\n  let x4D = $x as Tensor4D;\n  let\n reshapedTo4D = false;\n  if ($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x, [1, $x.shape[0],\n $x.shape[1], $x.shape[2]]);\n  }\n  util.assert(\n    x4D.rank === 4,\n    () => `Error in avgPool: x must be rank 4\n but got rank ${x4D.rank}.`);\n  if (dimRoundingMode != null) {\n    util.assert(\n      util.isInt(pad as number),\n      () => `Error in avgPool: pad must be an integer when using, ` +\n        `dimRoundingMode\n ${dimRoundingMode} but got pad ${pad}.`);\n  }\n  const inputs: AvgPoolInputs = {x: x4D};\n  const attrs:\n AvgPoolAttrs = {filterSize, strides, pad, dimRoundingMode};\n  // tslint:disable-next-line: no-unnecessary-type-\n assertion\n  let res = ENGINE.runKernel(\n    AvgPool, inputs as {} as NamedTensorMap,\n    attrs\n as {} as NamedAttrMap) as T;\n  res = cast(res, $x.dtype);\n  if (reshapedTo4D) {\n    return reshape(res,\n [res.shape[1], res.shape[2], res.shape[3]]) as T;\n  }\n  return res;\n}\n\nexport const avgPool =\n op({avgPool_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {cast} from\n './cast';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the 3D average\n pooling.\n * @param x const x = tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]);\n * const result = tf.avgPool3d(x,\n 2, 1, 'valid');\n * result.print();\n * \n * @param x The input tensor, of rank 5 or rank 4 of shape\n *   [batch,\n depth, height, width, inChannels]. \n * @param filterSize The filter size:\n *   [filterDepth, filterHeight,\n filterWidth]. \n *   If `filterSize` is a single number,\n *   then `filterDepth == filterHeight == filterWidth`. \n */\n
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@param strides The strides of the pooling:\n * ` [strideDepth, strideHeight, strideWidth]`.\n * If `strides` is a single number,\n * then `strideDepth == strideHeight == strideWidth`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1*1x1.\n * - For more info, see this guide:\n * https://www.tensorflow.org/api_guides/python/nn#Convolution\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution]\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n * @param dataType An optional string from: \"NDHWC\", \"NCDHW\". Defaults to\n * \"NDHWC\". Specify the data format of the input and output data. With the\n * default format \"NDHWC\", the data is stored in the order of: [batch,\n * depth, height, width, channels]. Only \"NDHWC\" is currently supported.\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n * @function avgPool3d<T extends Tensor4D|Tensor5D>(x: T|TensorLike, filterSize: [number, number, number]|number, strides: [number, number, number]|number, pad: 'valid'|'same'|number, dimRoundingMode?: 'floor'|'round'|'ceil', dataType: 'NDHWC'|'NCDHW' = 'NDHWC'): T {\n * const \$x = convertToTensor(x, 'x', 'avgPool3d', 'float32');\n * let x5D = \$x as Tensor5D;\n * let reshapedTo5D = false;\n * if (\$x.rank === 4) {\n * reshapedTo5D = true;\n * x5D = reshape(\$x, [1, \$x.shape[0], \$x.shape[1], \$x.shape[2], \$x.shape[3]]);\n * }\n * util.assert(x5D.rank === 5, () => `Error in avgPool3d: x must be rank 5 but got rank \${x5D.rank}.`);\n * util.assert(dataFormat === 'NDHWC', () => `Error in avgPool3d: Only NDHWC is currently supported, ` +\n * `but got dataType of \${dataType}`);\n * if (dimRoundingMode != null) {\n * util.assert(util.isInt(pad as number), () => `Error in avgPool3d: pad must be an integer when using, ` +\n * `dimRoundingMode \${dimRoundingMode} but got pad \${pad}.`);\n * }\n * const inputs:\n * AvgPool3DInputs = {x: x5D};\n * const attrs:\n * AvgPool3DAttrs = {filterSize, strides, pad, dimRoundingMode, dataType};\n * // tslint:disable-next-line: no-unnecessary-type-assertion\n * let res = ENGINE.runKernel(\n * AvgPool3D, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as T;\n * res = cast(res, x5D.dtype);\n * if (reshapedTo5D) {\n * return reshape(res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as\n * T;\n * }\n * return res;\n * };\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * =====\n * @import {ENGINE} from '../engine';\n * import {Concat, ConcatAttrs, ConcatInputs} from '../kernel_names';\n * import {NamedAttrMap} from '../kernel_registry';\n * import {Tensor} from '../tensor';\n * import {NamedTensorMap} from '../tensor_types';\n * import {convertToTensorArray} from '../tensor_util_env';\n * import {TensorLike} from '../types';\n * import {assert} from '../util';\n * import {clone} from './clone';\n * import {op} from './operation';\n * Concatenates a list of `tf.Tensor`s along a given axis.\n * The tensors ranks and types must match, and their sizes must match in all\n * dimensions except `axis`.\n * Also available are stricter rank-specific methods that assert that\n * tensors are of the given rank:\n * - `tf.concat1d`\n * - `tf.concat2d`\n * - `tf.concat3d`\n * - `tf.concat4d`\n * Except `tf.concat1d` (which does not have axis param), all methods have\n * same signature as this method.\n * ```js\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * a.concat(b).print(); // or a.concat(b)\n * ```\n * ```js\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.concat([a, b, c]).print();\n * ```\n * ```js\n * const a = tf.tensor2d([[1, 2], [10, 20]]);\n * const b = tf.tensor2d([[3, 4], [30, 40]]);\n * const axis = 1;\n * tf.concat([a, b], axis).print();\n * ```\n * @param tensors A list of tensors to concatenate.\n * @param axis The axis to concatenate along. Defaults to 0 (the first dim).\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n * @function concat<T extends Tensor>(tensors: Array<T|TensorLike>, axis = 0): T {\n * assert(tensors.length >= 1, () => `Pass at least one tensor to concat`);\n * const \$tensors =\n * convertToTensorArray(tensors, 'tensors', 'concat',

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=====
*\n\nimport {ENGINE} from './engine';\nimport {Tanh, TanhInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes hyperbolic tangent of the input `tf.Tensor` element-wise:  $\tanh(x)$ \n * const x = tf.tensor1d([0, 1, -1, 70]);\n * x.tanh().print(); // or tf.tanh(x)\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n function tanh_<T extends Tensor>(x: T|TensorLike): T {\n   const $x = convertToTensor(x, 'x', 'tanh');\n   const inputs: TanhInputs = {x: $x};\n   return ENGINE.runKernel(Tanh, inputs as { } as NamedTensorMap);\n }\n\nexport const tanh = op({tanh_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====
*\n\nimport {Scalar, Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {add} from './add';\nimport {concat} from './concat';\nimport {matMul} from './mat_mul';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {sigmoid} from './sigmoid';\nimport {slice} from './slice';\nimport {tanh} from './tanh';\n\n/**\n * Computes the next state and output of a BasicLSTMCell.\n * Returns  $[newC, newH]$ . Derived from tf.contrib.rnn.BasicLSTMCell.  
\n * @param forgetBias Forget bias for the cell.  
\n * @param lstmKernel The weights for the cell.  
\n * @param lstmBias The bias for the cell.  
\n * @param data The input to the cell.  
\n * @param c Previous cell state.  
\n * @param h Previous cell output.  
\n * @doc {heading: 'Operations', subheading: 'RNN'}\n *\n function basicLSTMCell_(\n   forgetBias: Scalar|TensorLike, lstmKernel: Tensor2D|TensorLike,\n   lstmBias: Tensor1D|TensorLike, data: Tensor2D|TensorLike,\n   c: Tensor2D|TensorLike, h: Tensor2D|TensorLike): [Tensor2D, Tensor2D] {\n   const $forgetBias =\n     convertToTensor(forgetBias, 'forgetBias', 'basicLSTMCell');\n   const $lstmKernel =\n     convertToTensor(lstmKernel, 'lstmKernel', 'basicLSTMCell');\n   const $lstmBias =\n     convertToTensor(lstmBias, 'lstmBias', 'basicLSTMCell');\n   const $data =\n     convertToTensor(data, 'data', 'basicLSTMCell');\n   const $c =\n     convertToTensor(c, 'c', 'basicLSTMCell');\n   const $h =\n     convertToTensor(h, 'h', 'basicLSTMCell');\n   const combined = concat([$data, $h], 1);\n   const weighted =\n     matMul(combined, $lstmKernel);\n   const res: Tensor2D = add(weighted, $lstmBias);\n   // i = input_gate, j = new_input, f = forget_gate, o = output_gate\n   const batchSize = res.shape[0];\n   const sliceCols = res.shape[1] / 4;\n   const sliceSize: [number, number] = [batchSize, sliceCols];\n   const i = slice(res, [0, 0], sliceSize);\n   const j = slice(res, [0, sliceCols], sliceSize);\n   const f = slice(res, [0, sliceCols * 2], sliceSize);\n   const o = slice(res, [0, sliceCols * 3], sliceSize);\n   const newC: Tensor2D =\n     add(mul(sigmoid(i), tanh(j)), mul($c, sigmoid(add($forgetBias, f)) as Tensor2D));\n   const newH: Tensor2D = mul(tanh(newC), sigmoid(o));\n   return [newC, newH];\n }\n\nexport const basicLSTMCell = op({basicLSTMCell_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```
=====
import {ENGINE} from '../engine';import {BatchToSpaceND, BatchToSpaceNDAttrs,
BatchToSpaceNDInputs} from '../kernel_names';import {NamedAttrMap} from '../kernel_registry';import
{Tensor} from '../tensor';import {NamedTensorMap} from '../tensor_types';import {convertToTensor} from
../tensor_util_env';import {TensorLike} from '../types';import * as util from '../util';import {op} from
../operation';
/**
 * This operation reshapes the "batch" dimension 0 into `M + 1` dimensions of shape
 `blockShape + [batch]`, interleaves these blocks back into the grid defined by the spatial dimensions `[1, ..., M]`,
 to obtain a result with the same rank as the input. The spatial dimensions of this intermediate result are then
 optionally cropped according to `crops` to produce the output. This is the reverse of `tf.spaceToBatchND`. See
 below for a precise description.
 js
 const x = tf.tensor4d([1, 2, 3, 4], [4, 1, 1, 1]);
 const
 blockShape = [2, 2];
 const crops = [[0, 0], [0, 0]];
 x.batchToSpaceND(blockShape, crops).print();
 @param x A `tf.Tensor`. N-D with `x.shape` = `[batch] + spatialShape + remainingShape`, where
 spatialShape has `M` dimensions.
 @param blockShape A 1-D array. Must have shape `[M]`, all values must
 be  $\geq 1$ .
 @param crops A 2-D array. Must have shape `[M, 2]`, all values must be  $\geq 0$ . `crops[i] =
 [cropStart, cropEnd]` specifies the amount to crop from input dimension  $i + 1$ , which corresponds to spatial
 dimension  $i$ . It is required that  $\text{cropStart}[i] + \text{cropEnd}[i] \leq \text{blockShape}[i] * \text{inputShape}[i + 1]$ .
 This operation is equivalent to the following steps:
 1. Reshape `x` to `reshaped` of shape: `[blockShape[0], ..., blockShape[M-1], batch / prod(blockShape), x.shape[1], ..., x.shape[N-1]]`
 2. Permute dimensions of `reshaped` to produce `permuted` of shape `[batch / prod(blockShape), x.shape[1], blockShape[0], ...,
 x.shape[M], blockShape[M-1], x.shape[M+1], ..., x.shape[N-1]]`
 3. Reshape `permuted` to produce `reshapedPermuted` of shape `[batch / prod(blockShape), x.shape[1] * blockShape[0], ..., x.shape[M] *
 blockShape[M-1], x.shape[M+1], ..., x.shape[N-1]]`
 4. Crop the start and end of dimensions `[1, ..., M]` of `reshapedPermuted` according to `crops` to produce the output of shape:
 `[batch / prod(blockShape), x.shape[1] * blockShape[0] - crops[0,0] - crops[0,1], ..., x.shape[M] * blockShape[M-1] -
 crops[M-1,0] - crops[M-1,1], x.shape[M+1], ..., x.shape[N-1]]`
 @doc {heading: 'Tensors', subheading:
 'Transformations'}
function batchToSpaceND<T extends Tensor>(x: T | TensorLike, blockShape:
number[], crops: number[][]): T {
  const $x = convertToTensor(x, 'x', 'batchToSpaceND');
  const prod =
blockShape.reduce((a, b) => a * b);
  util.assert($x.rank  $\geq$  1 + blockShape.length, () => `input rank is
${$x.rank} but should be > than blockShape.length ${blockShape.length}`);
  util.assert(crops.length === blockShape.length, () => `crops.length is ${crops.length} but should be equal to
blockShape.length ${blockShape.length}`);
  util.assert($x.shape[0] % prod === 0, () =>
`input tensor batch is ${$x.shape[0]} but is not divisible by the product of ` +
the elements of
blockShape ${blockShape.join(' *')} === ${prod}`);
  const inputs: BatchToSpaceNDInputs = {x: $x};
  const
attrs: BatchToSpaceNDAttrs = {blockShape, crops};
  return ENGINE.runKernel(BatchToSpaceND, inputs
as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}
export const batchToSpaceND =
op({batchToSpaceND_});
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```
import {Tensor, Tensor4D} from '../tensor';import {Rank} from '../types';import {reshape} from
../reshape';
export function xAs4D<R extends Rank>(x: Tensor<R>) {
  let x4D: Tensor4D;
  if (x.rank === 0
|| x.rank === 1) {
    x4D = reshape(x, [1, 1, 1, x.size]);
  } else if (x.rank === 2) {
    x4D = reshape(x, [1, 1,
x.shape[0], x.shape[1]]);
  } else if (x.rank === 3) {
    x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);
  }
}
```



```

} else {\n  x4D = x as Tensor4D;\n }\n\n return x4D;\n}\n"/**\n * @license\n * Copyright 2020 Google LLC.  
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this  
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {FusedBatchNorm, FusedBatchNormAttrs,  
FusedBatchNormInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport  
{Tensor, Tensor1D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport  
{convertToTensor} from './tensor_util_env';\nimport {Rank, TensorLike} from './types';\nimport * as util from  
 './util';\nimport {xAs4D} from './batchnorm_util';\nimport {op} from './operation';\nimport {reshape} from  
 './reshape';\n\n/**\n * Batch normalization.\n *\n * As described in\n *\n [http://arxiv.org/abs/1502.03167](http://arxiv.org/abs/1502.03167).\n *\n * Mean, variance, scale, and offset can be  
of two shapes:\n * - The same shape as the input.\n * - In the common case, the depth dimension is the last  
dimension of x, so\n * the values would be an `tf.Tensor1D` of shape [depth].\n *\n * Also available are stricter  
rank-specific methods with the same signature\n * as this method that assert that parameters passed are of given  
rank\n * - `tf.batchNorm2d`\n * - `tf.batchNorm3d`\n * - `tf.batchNorm4d`\n *\n * @param x The input  
Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset  
Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by  
0.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n */\nfunction batchNorm<R> extends  
Rank>(\n  x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike,\n  variance:  
Tensor<R>|Tensor1D|TensorLike,\n  offset?: Tensor<R>|Tensor1D|TensorLike,\n  scale?:  
Tensor<R>|Tensor1D|TensorLike,\n  varianceEpsilon?: number): Tensor<R> {\n  if (varianceEpsilon == null) {\n    varianceEpsilon = 0.001;\n  }\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean =  
convertToTensor(mean, 'mean', 'batchNorm');\n  const $variance = convertToTensor(variance, 'variance',  
'batchNorm');\n  let $scale: Tensor<R>|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale',  
'batchNorm');\n  }\n  let $offset: Tensor<R>|Tensor1D;\n  if (offset != null) {\n    $offset = convertToTensor(offset,  
'offset', 'batchNorm');\n  }\n  util.assert(\n    $mean.rank === $variance.rank,\n    () => 'Batch normalization  
gradient requires mean and variance to have ' +\n    'equal ranks.);\n  util.assert(\n    $offset == null ||  
$mean.rank === $offset.rank,\n    () => 'Batch normalization gradient requires mean and offset to have ' +\n    'equal ranks.);\n  util.assert(\n    $scale == null || $mean.rank === $scale.rank,\n    () => 'Batch normalization  
gradient requires mean and scale to have ' +\n    'equal ranks.);\n  \n  const x4D: Tensor4D = xAs4D($x);\n  \n  const inputs: FusedBatchNormInputs = {\n    x: x4D,\n    scale: $scale,\n    offset: $offset,\n    mean: $mean,\n    variance: $variance\n  };\n  \n  const attrs: FusedBatchNormAttrs = {varianceEpsilon};\n  \n  // tslint:disable-next-line:  
no-unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n    FusedBatchNorm, inputs as {} as  
NamedTensorMap,\n    attrs as {} as NamedAttrMap) as Tensor<R>;\n  \n  return reshape(res,  
$x.shape);\n}\n\nexport const batchNorm = op({batchNorm});\n"/**\n * @license\n * Copyright 2020 Google  
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not  
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport  
{TensorLike} from './types';\nimport * as util from './util';\nimport {batchNorm} from './batchnorm';\nimport

```

```

{op} from './operation';\n\n/**\n * Batch normalization, strictly for 2D. For the more relaxed version, see\n *
`tf.batchNorm`. \n * \n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A
variance Tensor.\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param
varianceEpsilon A small float number to avoid dividing by 0.\n */\nfunction batchNorm2d_(\n  x:
Tensor2D|TensorLike, mean: Tensor2D|Tensor1D|TensorLike, \n  variance: Tensor2D|Tensor1D|TensorLike, \n
offset?: Tensor2D|Tensor1D|TensorLike, scale?: Tensor2D|Tensor1D|TensorLike, \n  varianceEpsilon?: number):
Tensor2D {\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean = convertToTensor(mean, 'mean',
'batchNorm');\n  const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n  let $scale:
Tensor2D|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale', 'batchNorm');\n  }\n  let
$offset: Tensor2D|Tensor1D;\n  if (offset != null) {\n    $offset = convertToTensor(offset, 'offset', 'batchNorm');\n
  }\n  util.assert(\n    $x.rank === 2, \n    () => `Error in batchNorm2D: x must be rank 2 but got rank ` + \n
`${$x.rank}.`);\n  util.assert(\n    $mean.rank === 2 || $mean.rank === 1, \n    () => `Error in batchNorm2D: mean
must be rank 2 or rank 1 but ` + \n    `got rank ${$mean.rank}.`);\n  util.assert(\n    $variance.rank === 2 ||
$variance.rank === 1, \n    () => `Error in batchNorm2D: variance must be rank 2 or rank 1 ` + \n    `but got rank
${$variance.rank}.`);\n  if ($scale != null) {\n    util.assert(\n    $scale.rank === 2 || $scale.rank === 1, \n    () =>
`Error in batchNorm2D: scale must be rank 2 or rank 1 ` + \n    `but got rank ${$scale.rank}.`);\n  }\n  if ($offset
!= null) {\n    util.assert(\n    $offset.rank === 2 || $offset.rank === 1, \n    () => `Error in batchNorm2D: offset
must be rank 2 or rank 1 ` + \n    `but got rank ${$offset.rank}.`);\n  }\n  return batchNorm($x, $mean,
$variance, $offset, $scale, varianceEpsilon);\n}\n\nexport const batchNorm2d = op({batchNorm2d_});\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor1D, Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {batchNorm} from './batchnorm';\nimport
{op} from './operation';\n\n/**\n * Batch normalization, strictly for 3D. For the more relaxed version, see\n *
`tf.batchNorm`. \n * \n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A
variance Tensor.\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param
varianceEpsilon A small float number to avoid dividing by 0.\n */\nfunction batchNorm3d_(\n  x:
Tensor3D|TensorLike, mean: Tensor3D|Tensor1D|TensorLike, \n  variance: Tensor3D|Tensor1D|TensorLike, \n
offset?: Tensor3D|Tensor1D|TensorLike, scale?: Tensor3D|Tensor1D|TensorLike, \n  varianceEpsilon?: number):
Tensor3D {\n  const $x = convertToTensor(x, 'x', 'batchNorm');\n  const $mean = convertToTensor(mean, 'mean',
'batchNorm');\n  const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n  let $scale:
Tensor3D|Tensor1D;\n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale', 'batchNorm');\n  }\n  let
$offset: Tensor3D|Tensor1D;\n  if (offset != null) {\n    $offset = convertToTensor(offset, 'offset', 'batchNorm');\n
  }\n  util.assert(\n    $x.rank === 3, \n    () => `Error in batchNorm3D: x must be rank 3 but got rank ` + \n
`${$x.rank}.`);\n  util.assert(\n    $mean.rank === 3 || $mean.rank === 1, \n    () => `Error in batchNorm3D: mean
must be rank 3 or rank 1 but ` + \n    `got rank ${$mean.rank}.`);\n  util.assert(\n    $variance.rank === 3 ||
$variance.rank === 1, \n    () => `Error in batchNorm3D: variance must be rank 3 or rank 1 ` + \n    `but got rank
${$variance.rank}.`);\n  if ($scale != null) {\n    util.assert(\n    $scale.rank === 3 || $scale.rank === 1, \n    () =>
`Error in batchNorm3D: scale must be rank 3 or rank 1 ` + \n    `but got rank ${$scale.rank}.`);\n  }\n  if ($offset
!= null) {\n    util.assert(\n    $offset.rank === 3 || $offset.rank === 1, \n    () => `Error in batchNorm3D: offset
must be rank 3 or rank 1 ` + \n    `but got rank ${$offset.rank}.`);\n  }\n  return batchNorm($x, $mean,
$variance, $offset, $scale, varianceEpsilon);\n}\n\nexport const batchNorm3d = op({batchNorm3d_});\n", "/*\n *
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```

2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at <http://www.apache.org/licenses/LICENSE-2.0> Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
* \nimport {Tensor1D, Tensor4D} from './tensor'; \nimport {convertToTensor} from './tensor_util_env'; \nimport
{TensorLike} from './types'; \nimport * as util from './util'; \n\nimport {batchNorm} from './batchnorm'; \nimport
{op} from './operation'; \n\n/** \n * Batch normalization, strictly for 4D. For the more relaxed version, see
`tf.batchNorm`. \n * @param x The input Tensor. \n * @param mean A mean Tensor. \n * @param variance A
variance Tensor. \n * @param offset An offset Tensor. \n * @param scale A scale Tensor. \n * @param
varianceEpsilon A small float number to avoid dividing by 0. \n */ \nfunction batchNorm4d(\n  x:
Tensor4D|TensorLike, mean: Tensor4D|Tensor1D|TensorLike, \n  variance: Tensor4D|Tensor1D|TensorLike, \n
offset?: Tensor4D|Tensor1D|TensorLike, scale?: Tensor4D|Tensor1D|TensorLike, \n  varianceEpsilon?: number):
Tensor4D {\n  const $x = convertToTensor(x, 'x', 'batchNorm'); \n  const $mean = convertToTensor(mean, 'mean',
'batchNorm'); \n  const $variance = convertToTensor(variance, 'variance', 'batchNorm'); \n  let $scale:
Tensor4D|Tensor1D; \n  if (scale != null) {\n    $scale = convertToTensor(scale, 'scale', 'batchNorm'); \n  } \n  let
$offset: Tensor4D|Tensor1D; \n  if (offset != null) {\n    $offset = convertToTensor(offset, 'offset', 'batchNorm'); \n
  } \n  util.assert(\n    $x.rank === 4, \n    () => `Error in batchNorm4D: x must be rank 4 but got rank ` + \n
`${$x.rank}.`); \n  util.assert(\n    $mean.rank === 4 || $mean.rank === 1, \n    () => `Error in batchNorm4D: mean
must be rank 4 or rank 1 but ` + \n    `got rank ${$mean.rank}.`); \n  util.assert(\n    $variance.rank === 4 ||
$variance.rank === 1, \n    () => `Error in batchNorm4D: variance must be rank 4 or rank 1 ` + \n    `but got rank
${$variance.rank}.`); \n  if ($scale != null) {\n    util.assert(\n    $scale.rank === 4 || $scale.rank === 1, \n    () =>
`Error in batchNorm4D: scale must be rank 4 or rank 1 ` + \n    `but got rank ${$scale.rank}.`); \n  } \n  if ($offset
!= null) {\n    util.assert(\n    $offset.rank === 4 || $offset.rank === 1, \n    () => `Error in batchNorm4D: offset
must be rank 4 or rank 1 ` + \n    `but got rank ${$offset.rank}.`); \n  } \n  return batchNorm($x, $mean,
$variance, $offset, $scale, varianceEpsilon); \n} \n\nexport const batchNorm4d = op({batchNorm4d}); \n", /** \n *
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2.0 (the "License"); \n * you may not use this file except in compliance with the License. \n * You may obtain a
copy of the License at \n * http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable
law or agreed to in writing, software \n * distributed under the License is distributed on an "AS IS" BASIS, \n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for
the specific language governing permissions and \n * limitations under the License. \n *
=====
```

```
=====
* \nimport {ENGINE} from './engine'; \nimport {Bincount, BincountAttrs, BincountInputs} from
'./kernel_names'; \nimport {NamedAttrMap} from './kernel_registry'; \nimport {Tensor1D} from './tensor'; \nimport
{NamedTensorMap} from './tensor_types'; \nimport {convertToTensor} from './tensor_util_env'; \nimport
{TensorLike} from './types'; \nimport * as util from './util'; \n\nimport {op} from './operation'; \n\n/** \n * Outputs a
vector with length `size` and the same dtype as `weights`. \n * If `weights` are empty, then index `i` stores the
number of times the value \n * `i` is counted in `x`. If `weights` are non-empty, then index `i` stores the \n * sum of
the value in `weights` at each index where the corresponding value in \n * `x` is `i`. \n * Values in `x` outside of
the range [0, size) are ignored. \n * @param x The input int tensor, rank 1. \n * @param weights The weights
tensor, must have the same shape as x, or a \n * length-0 Tensor, in which case it acts as all weights equal to 1. \n *
@param size Non-negative integer. \n * @doc {heading: 'Operations', subheading: 'Reduction'} \n */ \nfunction
bincount_<T> extends Tensor1D<(\n  x: T|TensorLike, weights: T|TensorLike, size: number): T {\n  const $x =
convertToTensor(x, 'x', 'bincount'); \n  const $weights = convertToTensor(weights, 'weights', 'bincount'); \n  \n
util.assert(\n    $x.dtype === 'int32', \n    () => `Error in bincount: input ` + \n    `dtype must be int32, but got
${$x.dtype}.`); \n  util.assert(size >= 0, () => `size must be non-negative, but got ${size}.`); \n  util.assert(\n
```



```

convertToTensor(x, 'x', 'ceil');\n\n const inputs: CeilInputs = {x: $x};\n return ENGINE.runKernel(Ceil, inputs as
{ } as NamedTensorMap);\n}\nexport const ceil = op({ceil_});\n", "/*\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {ENGINE} from './engine';\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n**\n * Clips
values element-wise. max(min(x, clipValueMax), clipValueMin)\n *\n * ``js\n * const x = tf.tensor1d([-1, 2, -3,
4]);\n *\n * x.clipByValue(-2, 3).print(); // or tf.clipByValue(x, -2, 3)\n * ``\n * @param x The input tensor.\n *
@param clipValueMin Lower-bound of range to be clipped to.\n * @param clipValueMax Upper-bound of range to
be clipped to.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction clipByValue<T
extends Tensor>(\n  x: T|TensorLike, clipValueMin: number, clipValueMax: number): T {\n  const $x =
convertToTensor(x, 'x', 'clipByValue');\n  util.assert(\n    (clipValueMin <= clipValueMax),\n    () => `Error in
clip: min (${clipValueMin}) must be ` +\n      `less than or equal to max (${clipValueMax}).`);\n\n  const inputs:
ClipByValueInputs = {x: $x};\n  const attrs: ClipByValueAttrs = {clipValueMin, clipValueMax};\n\n  return
ENGINE.runKernel(\n    ClipByValue, inputs as { } as NamedTensorMap, attrs as { } as
NamedAttrMap);\n}\n\nexport const clipByValue = op({clipByValue_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor1D} from './tensor';\nimport {TensorLike} from './types';\nimport {concat} from
 './concat';\nimport {op} from './operation';\n\n**\n * Concatenates a list of tf.Tensor1D`s along an axis. See
`concat` for details.\n *\n * For example, if:\n * A: shape(3) = |r1, g1, b1|\n * B: shape(2) = |r2, g2|\n * C =
tf.concat1d([A, B]) == |r1, g1, b1, r2, g2|\n *\n * @param tensors A list of tf.Tensor`s to concatenate.\n * @return
The concatenated array.\n *\nfunction concat1d_(tensors: Array<Tensor1D|TensorLike>): Tensor1D {\n  return
concat(tensors, 0 /* axis */);\n}\n\nexport const concat1d = op({concat1d_});\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```

```

=====\n
*\nimport {Tensor2D} from './tensor';\nimport {TensorLike} from './types';\nimport {concat} from
 './concat';\nimport {op} from './operation';\n\n**\n * Concatenates a list of tf.Tensor2D`s along an axis. See
`concat` for details.\n *\n * For example, if:\n * A: shape(2, 3) = | r1, g1, b1 |\n * | r2, g2, b2 |\n * B:
shape(2, 3) = | r3, g3, b3 |\n * | r4, g4, b4 |\n *\n * C = tf.concat2d([A, B], axis)\n *\n * if axis = 0:\n * C:
shape(4, 3) = | r1, g1, b1 |\n * | r2, g2, b2 |\n * | r3, g3, b3 |\n * | r4, g4, b4 |\n *\n * if

```

```

axis = 1:\n * C = shape(2, 6) = | r1, g1, b1, r3, g3, b3 |\n *          | r2, g2, b2, r4, g4, b4 |\n *\n * @param
tensors A list of `tf.Tensor`s to concatenate.\n * @param axis The axis to concatenate along.\n * @return The
concatenated array.\n *\nfunction concat2d_(\n  tensors: Array<Tensor2D|TensorLike>, axis: number): Tensor2D
{\n  return concat(tensors, axis);\n}\n\nexport const concat2d = op({concat2d_});\n", "/*\n * @license\n *
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`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor3D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from
'./concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of `tf.Tensor3D`s along an axis.\n * See
`concat` for details.\n *\n * For example, if:\n * A: shape(2, 1, 3) = | r1, g1, b1 |\n *          | r2, g2, b2 |\n *\n * B: shape(2, 1, 3) = | r3, g3, b3 |\n *          | r4, g4, b4 |\n *\n * C = tf.concat3d([A, B], axis)\n *\n * if axis =
0:\n * C: shape(4, 1, 3) = | r1, g1, b1 |\n *          | r2, g2, b2 |\n *          | r3, g3, b3 |\n *          | r4,
g4, b4 |\n *\n * if axis = 1:\n * C: shape(2, 2, 3) = | r1, g1, b1, r3, g3, b3 |\n *          | r2, g2, b2, r4, g4, b4 |\n
*\n * if axis = 2:\n * C = shape(2, 1, 6) = | r1, g1, b1, r3, g3, b3 |\n *          | r2, g2, b2, r4, g4, b4 |\n *\n
*\n * @param tensors A list of `tf.Tensor`s to concatenate.\n * @param axis The axis to concate along.\n * @return The
concatenated array.\n *\nfunction concat3d_(\n  tensors: Array<Tensor3D|TensorLike>, axis: number): Tensor3D
{\n  return concat(tensors, axis);\n}\n\nexport const concat3d = op({concat3d_});\n", "/*\n * @license\n *
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`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor4D} from './tensor';\nimport {TensorLike} from './types';\n\nimport {concat} from
'./concat';\nimport {op} from './operation';\n\n/**\n * Concatenates a list of `tf.Tensor4D`s along an axis.\n * See
`concat` for details.\n *\n * @param tensors A list of `tf.Tensor`s to concatenate.\n * @param axis The axis to
concate along.\n * @return The concatenated array.\n *\nfunction concat4d_(\n  tensors:
Array<Tensor4D|TensorLike>, axis: number): Tensor4D {\n  return concat(tensors, axis);\n}\n\nexport const
concat4d = op({concat4d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\nimport {ENGINE} from './engine';\nimport {Conv2D, Conv2DAttrs, Conv2DInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport * as conv_util
from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D
convolution over the input x.\n *\n * @param x The input tensor, of rank 4 or rank 3, of shape\n *   `[batch, height,
width, inChannels]`. If rank 3, batch of 1 is\n *   assumed.\n *\n * @param filter The filter, rank 4, of shape\n *

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[filterHeight, filterWidth, inDepth, outDepth]`.\n * @param strides The strides of the convolution: `[strideHeight,\n * strideWidth]`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n *

[https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *

https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat: An optional string from:

`"NHWC"`, `"NCHW"`. Defaults to\n * `"NHWC"`. Specify the data format of the input and output data. With the\n * default format `"NHWC"`, the data is stored in the order of: [batch,\n * height, width, channels].\n *

@param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n * in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single\n * number, then `dilationHeight == dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n *

@param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv2d<T extends

Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor4D|TensorLike,\n strides: [number, number]|number,\n pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dilations:

[number, number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const \$x =\n convertToTensor(x, 'x', 'conv2d');\n const \$filter = convertToTensor(filter, 'filter', 'conv2d');\n let x4D = \$x as\n Tensor4D;\n let reshapedTo4D = false;\n if (\$x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape(\$x,\n [1, \$x.shape[0], \$x.shape[1], \$x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in conv2d:\n input must be rank 4, but got rank \${x4D.rank}.`);\n util.assert(\n \$filter.rank === 4,\n () => `Error in\n conv2d: filter must be rank 4, but got rank ` +\n ` \${\$filter.rank}.`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv2d: pad must be an integer when using, ` +\n ` ` +\n ` dimRoundingMode \${dimRoundingMode} but got pad \${pad}.`);\n }\n\n const inDepth = dataFormat ===

'NHWC' ? x4D.shape[3] : x4D.shape[1];\n util.assert(\n inDepth === \$filter.shape[2],\n () => `Error in\n conv2d: depth of input (\${inDepth}) must match ` +\n ` input depth for filter \${\$filter.shape[2]}.`);\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in conv2D: Either\n strides or dilations must be 1.` +\n ` Got strides \${strides} and dilations '\${dilations}'`);\n\n const inputs:

Conv2DInputs = {x: x4D, filter: \$filter};\n const attrs:\n Conv2DAttrs = {strides, pad, dataFormat, dilations,\n dimRoundingMode};\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =

ENGINE.runKernel(\n Conv2D, inputs as { } as NamedTensorMap,\n attrs as { } as\n NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n T;\n }\n return res;\n }\n\nexport const conv2d = op({conv2d_});\n"/**\n * @license\n * Copyright 2020 Google

LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *

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*\nimport {Tensor2D, Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {conv2d} from

'./conv2d';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from

'./reshape';\n"/**\n * Computes a 1D convolution over the input x.\n *\n * @param x The input tensor, of rank 3 or\n rank 2, of shape\n * `[batch, width, inChannels]`. If rank 2, batch of 1 is assumed.\n *\n * @param filter The filter,\n rank 3, of shape\n * `[filterWidth, inDepth, outDepth]`.\n *\n * @param stride The number of entries by which the\n filter is moved right at\n * each step.\n *\n * @param pad The type of padding algorithm.\n * - `same` and stride 1:

output will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input\n * if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n *\n *

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[https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat An optional string from
\'NWC\', \'NCW\'. Defaults to \'NWC\',\n * the data is stored in the order of [batch, in_width, in_channels].
Only\n * \'NWC\' is currently supported.\n * @param dilation The dilation rate in which we sample input values
in\n * atrous convolution. Defaults to `1`. If it is greater than 1, then\n * stride must be `1`.\n * @param
dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n *\n *
@doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction conv1d_<T extends
Tensor2D|Tensor3D>(\n x: T|TensorLike, filter: Tensor3D|TensorLike, stride: number,\n pad:
'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NWC'|'NCW' = 'NWC', dilation = 1,\n
dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x', 'conv1d');\n const $filter =
convertToTensor(filter, 'filter', 'conv1d');\n\n let x3D = $x as Tensor3D;\n let reshapedTo3D = false;\n if ($x.rank
=== 2) {\n reshapedTo3D = true;\n x3D = reshape($x, [1, $x.shape[0], $x.shape[1]]);\n }\n\n util.assert(\n
x3D.rank === 3,\n () => `Error in conv1d: input must be rank 3, but got rank ${x3D.rank}.`);\n util.assert(\n
$filter.rank === 3,\n () => `Error in conv1d: filter must be rank 3, but got rank ` +\n ` ${$filter.rank}.`);\n if
(dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv1d: pad
must be an integer when using, ` +\n ` dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n
}\n\n util.assert(\n x3D.shape[2] === $filter.shape[1],\n () => `Error in conv1d: depth of input
(${x3D.shape[2]}) must match ` +\n ` input depth for filter ${$filter.shape[1]}.`);\n util.assert(\n
conv_util.eitherStridesOrDilationsAreOne(stride, dilation),\n () => `Error in conv1D: Either stride or dilation
must be 1.` +\n `Got stride ${stride} and dilation '${dilation}'`);\n util.assert(\n dataFormat === 'NWC',\n
() => `Error in conv1d: got dataFormat of ${\n dataFormat} but only NWC is currently supported.`);\n\n
const filter4D = reshape(\n $filter, [1, $filter.shape[0], $filter.shape[1], $filter.shape[2]]);\n const input4D =
reshape(x3D, [x3D.shape[0], 1, x3D.shape[1], x3D.shape[2]]);\n const strides: [number, number] = [1, stride];\n
const dilations: [number, number] = [1, dilation];\n\n const conv2dDataFormat = 'NHWC';\n\n const res =
conv2d(\n (input4D as Tensor4D), (filter4D as Tensor4D), strides, pad,\n conv2dDataFormat, dilations,
dimRoundingMode);\n\n if (reshapedTo3D) {\n return reshape(res, [res.shape[2], res.shape[3]]) as T;\n }\n\n
return reshape(res, [res.shape[0], res.shape[2], res.shape[3]]) as T;\n}\n\n\nexport const conv1d =
op({conv1d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\nimport {ENGINE} from './engine';\nimport {Conv2DBackpropInput, Conv2DBackpropInputAttrs,
Conv2DBackpropInputInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from
'./util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes the derivative of the input of a 2D convolution.\n *\n * @param xShape The shape
of the input: [batch, height, width, inDepth].\n * If length of 3, batch of 1 is assumed.\n * @param dy The derivative
of the output, of rank 4 or rank 3 of shape\n * [batch, outHeight, outWidth, outDepth]. If rank 3, batch of 1 is\n *
assumed.\n * @param filter The filter, rank 4, of shape\n * [filterHeight, filterWidth, inDepth, outDepth].\n *
@param strides The strides of the convolution: [strideHeight,\n * strideWidth].\n * @param pad The type of
padding algorithm used:\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter
size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n * @param dataFormat: An
optional string from: 'NHWC', 'NCHW'. Defaults to\n * 'NHWC'. Specify the data format of the input and
output data. With the\n * default format 'NHWC', the data is stored in the order of: [batch,\n * height, width,

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channels].\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will
default to truncate.\n */\nfunction conv2DBackpropInput_<T extends Tensor3D|Tensor4D>(\n  xShape: [number,
number, number, number]|[number, number, number], dy: T,\n  filter: Tensor4D, strides: [number,
number]|[number,\n  pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n  dataFormat: 'NHWC'|'NCHW' =
'NHWC',\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  util.assert(\n    xShape.length === dy.rank,\n    ()
=> `Length of inShape ` +\n      `${xShape.length}` and rank of dy (${dy.rank}) must match`);\n\n  let xShape4D
= xShape as [number, number, number, number];\n  let dy4D = dy as Tensor4D;\n  let reshapedTo4D = false;\n  if
(dy.rank === 3) {\n    reshapedTo4D = true;\n    dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n
xShape4D = [1, xShape[0], xShape[1], xShape[2]];\n  }\n\n  util.assert(\n    xShape4D.length === 4,\n    () =>\n    `Error in conv2dDerInput: inShape must be length 4, but got length ` +\n      `${xShape4D.length}`);\n
util.assert(\n    dy4D.rank === 4,\n    () => `Error in conv2dDerInput: dy must be rank 4, but got ` +\n      `rank
${dy4D.rank}`);\n  util.assert(\n    filter.rank === 4,\n    () => `Error in conv2dDerInput: filter must be rank 4, but
got ` +\n      `rank ${filter.rank}`);\n  const inDepth = dataFormat === 'NHWC' ? xShape4D[3] : xShape4D[1];\n
const outDepth = dataFormat === 'NHWC' ? dy4D.shape[3] : dy4D.shape[1];\n  util.assert(\n    inDepth ===
filter.shape[2],\n    () => `Error in conv2dDerInput: depth of input (${inDepth}) must ` +\n      `match input
depth for filter ${filter.shape[2]}`);\n  util.assert(\n    outDepth === filter.shape[3],\n    () => `Error in
conv2dDerInput: depth of output (${outDepth}) must ` +\n      `match output depth for filter
${filter.shape[3]}`);\n  if (dimRoundingMode != null) {\n    util.assert(\n      util.isInt(pad as number),\n    () =>
`Error in conv2dDerInput: pad must be an integer when using, ` +\n      `dimRoundingMode
${dimRoundingMode} but got pad ${pad}`);\n  }\n\n  const inputs: Conv2DBackpropInputInputs = {dy: dy4D,
filter};\n\n  const attrs: Conv2DBackpropInputAttrs = {\n    strides, pad, dataFormat, dimRoundingMode,\n    inputShape: xShape4D};\n\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const res =
ENGINE.runKernel(\n    Conv2DBackpropInput, inputs as {} as NamedTensorMap,\n    attrs as {}
as NamedAttrMap) as T;\n\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])
as T;\n  }\n  return res;\n}\n\nexport const conv2DBackpropInput = op({conv2DBackpropInput_});\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====*\n
*/\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport {op}
from './operation';\n\n/**\n * Computes the transposed 2D convolution of an image, also known as a\n *
deconvolution.\n * @param x The input image, of rank 4 or rank 3, of shape\n * `[batch, height, width,
inDepth]`. If rank 3, batch of 1 is assumed.\n * @param filter The filter, rank 4, of shape\n * `[filterHeight,
filterWidth, outDepth, inDepth]`. \n * `inDepth` must match `inDepth` in `x`.\n * @param outputShape Output
shape, of rank 4 or rank 3:\n * `[batch, height, width, outDepth]`. If rank 3, batch of 1 is assumed.\n * @param
strides The strides of the original convolution:\n * `[strideHeight, strideWidth]`.\n * @param pad The type of
padding algorithm used in the non-transpose version\n * of the op.\n * @param dimRoundingMode A string from:
'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\n * @doc {heading: 'Operations',
subheading: 'Convolution'}\n */\nfunction conv2dTranspose_<T extends Tensor3D|Tensor4D>(\n  x:\n  T|TensorLike, filter: Tensor4D|TensorLike,\n  outputShape: [number, number, number, number]|[number, number,
number],\n  strides: [number, number]|number, pad: 'valid'|'same'|number,\n  dimRoundingMode?:
'floor'|'round'|'ceil'): T {\n  const $x = convertToTensor(x, 'x', 'conv2dTranspose');\n  const $filter =
convertToTensor(filter, 'filter', 'conv2dTranspose');\n\n  return conv2DBackpropInput(\n    outputShape, $x, $filter,
strides, pad, 'NHWC', dimRoundingMode);\n}\n\nexport const conv2dTranspose =

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op({conv2dTranspose_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\nimport {ENGINE} from './engine';\nimport {Conv3D, Conv3DAttrs, Conv3DInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport
{eitherStridesOrDilationsAreOne} from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes a 3D convolution over the input x.\n * @param x The input tensor, of rank 5 or
rank 4, of shape\n *   `[batch, depth, height, width, channels]`. If rank 4,\n *   batch of 1 is assumed.\n * @param filter The filter, rank 5, of shape\n *   `[filterDepth, filterHeight, filterWidth, inChannels, outChannels]`. \n *
inChannels must match between input and filter.\n * @param strides The strides of the convolution: `[strideDepth,
strideHeight,\n * strideWidth]`. \n * @param pad The type of padding algorithm. \n *   - `same` and stride 1: output
will be of same size as input,\n *   regardless of filter size. \n *   - `valid`: output will be smaller than input if filter
is larger\n *   than 1x1. \n * - For more info, see this guide:\n *   [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat: An optional string from:
`NDHWC`, `NCDHW`. Defaults to\n *   `NDHWC`. Specify the data format of the input and output data.
With the\n *   default format `NDHWC`, the data is stored in the order of: [batch,\n *   depth, height, width, channels]. Only `NDHWC` is currently supported.\n * @param dilations The dilation rates: `[dilationDepth,
dilationHeight,\n * dilationWidth]` in which we sample input values across the height\n *   and width
dimensions in atrous convolution. Defaults to `[1, 1, 1]`. \n *   If `dilations` is a single number, then\n *
`dilationDepth == dilationHeight == dilationWidth`. If it is greater\n *   than 1, then all values of `strides` must be
1.\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv3d<T> extends
Tensor4D|Tensor5D<(\n  x: T|TensorLike, filter: Tensor5D|TensorLike,\n  strides: [number, number,
number]|number, pad: 'valid'|'same',\n  dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC',\n  dilations: [number,
number, number]|number = [1, 1, 1]): T {\n  const $x = convertToTensor(x, 'x', 'conv3d');\n  const $filter =
convertToTensor(filter, 'filter', 'conv3d');\n  let x5D = $x as Tensor5D;\n  let reshapedTo5D = false;\n  if
($x.rank === 4) {\n    reshapedTo5D = true;\n    x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2],
$x.shape[3]]);\n  }\n  util.assert(\n    x5D.rank === 5,\n    () => `Error in conv3d: input must be rank 5, but got
rank ${x5D.rank}.`);\n  util.assert(\n    $filter.rank === 5,\n    () => `Error in conv3d: filter must be rank 5, but got
rank ` +\n    `${$filter.rank}.`);\n  util.assert(\n    x5D.shape[4] === $filter.shape[3],\n    () => `Error in
conv3d: depth of input (${x5D.shape[4]}) must match ` +\n    `input depth for filter ${$filter.shape[3]}.`);\n  util.assert(\n    eitherStridesOrDilationsAreOne(strides, dilations),\n    () => `Error in conv3D: Either strides or
dilations must be 1. ` +\n    `Got strides ${strides} and dilations '${dilations}'`);\n  util.assert(\n    dataFormat
=== 'NDHWC',\n    () => `Error in conv3d: got dataFormat of ${\n    dataFormat} but only NDHWC is
currently supported.`);\n  const inputs: Conv3DInputs = {x: x5D, filter: $filter};\n  const attrs: Conv3DAttrs =
{strides, pad, dataFormat, dilations};\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const res =
ENGINE.runKernel(\n    Conv3D, inputs as { } as NamedTensorMap,\n    attrs as { } as
NamedAttrMap) as T;\n  if (reshapedTo5D) {\n    return reshape(\n      res, [res.shape[1], res.shape[2],
res.shape[3], res.shape[4]]) as\n    T;\n  }\n  return res;\n}\n\nexport const conv3d = op({conv3d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a

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* \nimport {ENGINE} from './engine';\nimport {Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,\nConv3DBackpropInputV2Inputs} from './kernel_names';\nimport {NamedAttrMap} from\n './kernel_registry';\nimport {Tensor4D, Tensor5D} from './tensor';\nimport {NamedTensorMap} from\n './tensor_types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {reshape} from\n './reshape';\n\n/**\n * Computes the derivative of the input of a 3D convolution.\n * @param xShape The shape\n of the input: [batch, depth, height, width,\n * in_channels]. If length of 4, batch of 1 is assumed.\n * @param dy The\n derivative of the output, of rank 5 or rank 4 of shape\n * `[batch, outDepth, outHeight, outWidth, in_channels]`.\n * If rank 4, batch of 1 is assumed.\n * @param filter The filter, rank 5, of shape\n * `[filterDepth, filterHeight,\n filterWidth, inDepth, outDepth]`.\n * @param strides The strides of the convolution: `[strideDepth, strideHeight,\n * strideWidth]`.\n * @param pad The type of padding algorithm used:\n * - `same` and stride 1: output will be of\n same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is\n larger\n * than 1x1.\n */\nfunction conv3DBackpropInput_<T extends Tensor4D|Tensor5D>(\n xShape:\n [number, number, number, number,\n number][number, number, number, number],\n dy: T, filter: Tensor5D,\n strides: [number, number, number]number,\n pad: 'valid'|'same'): T {\n util.assert(\n xShape.length ===\n dy.rank,\n () => `Length of inShape ` +\n `(${xShape.length}) and rank of dy (${dy.rank}) must\n match`);\n let xShape5D = xShape as [number, number, number, number, number];\n let dy5D = dy as\n Tensor5D;\n let reshapedTo5D = false;\n if (dy.rank === 4) {\n reshapedTo5D = true;\n dy5D = reshape(dy, [1,\n dy.shape[0], dy.shape[1], dy.shape[2], dy.shape[3]]);\n xShape5D = [1, xShape[0], xShape[1], xShape[2],\n xShape[3]];\n }\n const inDepth = xShape5D[4];\n const outDepth = dy5D.shape[4];\n util.assert(\n xShape5D.length === 5,\n () => `Error in conv3dDerInput: inShape must be length 5, but got length ` +\n `(${xShape5D.length}).`);\n util.assert(\n dy5D.rank === 5,\n () => `Error in conv3dDerInput: dy must be\n rank 5, but got ` +\n `rank ${dy5D.rank}`);\n util.assert(\n filter.rank === 5,\n () => `Error in\n conv3dDerInput: filter must be rank 5, but got ` +\n `rank ${filter.rank}`);\n util.assert(\n inDepth ===\n filter.shape[3],\n () => `Error in conv3dDerInput: depth of input (${inDepth}) must ` +\n `match input\n depth for filter ${filter.shape[3]}.`);\n util.assert(\n outDepth === filter.shape[4],\n () => `Error in\n conv3dDerInput: depth of output (${outDepth}) must ` +\n `match output depth for filter\n ${filter.shape[4]}.`);\n const inputs: Conv3DBackpropInputV2Inputs = {dy: dy5D, filter};\n const attrs:\n Conv3DBackpropInputV2Attrs = {pad, strides, inputShape: xShape5D};\n // tslint:disable-next-line: no-\n unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Conv3DBackpropInputV2, inputs as {\n as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n\n if (reshapedTo5D) {\n return\n reshape(\n res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as\n T;\n }\n return\n res;\n}\n\nexport const conv3DBackpropInput = op({conv3DBackpropInput_});\n\n/**\n * @license\n * Copyright\n 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n=====  
* \nimport {Tensor4D, Tensor5D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\nimport {conv3DBackpropInput} from './conv3d_backprop_input';\nimport {op}\n from './operation';\n\n/**\n * Computes the transposed 3D convolution of a volume, also known as a\n * deconvolution.\n * @param x The input image, of rank 5 or rank 4, of shape\n * `[batch, depth, height, width,
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*\n\nimport {ENGINE} from './engine';\nimport {Cumsum, CumsumAttrs, CumsumInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes the cumulative sum of a
 `tf.Tensor` along `axis`\n * \n * ```\n * const x = tf.tensor([1, 2, 3, 4]);\n * x.cumsum().print();\n * ```\n * ```\n * const x = tf.tensor([[1, 2], [3, 4]]);\n * x.cumsum().print();\n * ```\n * \n * @param x The input tensor to be
 summed.\n * @param axis The axis along which to sum. Optional. Defaults to 0.\n * @param exclusive Whether to
 perform exclusive cumulative sum. Optional.\n * Defaults to false. If set to true then the sum of each tensor
 entry\n * does not include its own value, but only the values previous to it\n * along the specified axis.\n *
 @param reverse Whether to sum in the opposite direction. Optional.\n * Defaults to false.\n * \n * @doc
 {heading: 'Operations', subheading: 'Scan'}\n */\nfunction cumsum_

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*\n\nimport {ENGINE} from './engine';\nimport {DenseBincount, DenseBincountAttrs, DenseBincountInputs}
 from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D, Tensor2D} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from
 './operation';\n\n/**\n * Outputs a vector with length `size` and the same dtype as `weights`\n * \n * If `weights`
 are empty, then index `i` stores the number of times the value\n * `i` is counted in `x`. If `weights` are non-empty, then
 index `i` stores the\n * sum of the value in `weights` at each index where the corresponding value in\n * `x` is `i`.\n *
 \n * Values in `x` outside of the range [0, size) are ignored.\n * \n * @param x The input int tensor, rank 1 or rank
 2.\n * @param weights The weights tensor, must have the same shape as x, or a\n * length-0 Tensor, in which
 case it acts as all weights equal to 1.\n * @param size Non-negative integer.\n * @param binaryOutput Optional.
 Whether the kernel should count the appearance\n * or number of occurrences. Defaults to False.\n * \n * @doc
 {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction denseBincount_

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./tensor_util_env';\n\nimport {op} from './operation';\n\n/**\n * Returns a diagonal tensor with a given diagonal\n * values.\n * Given a diagonal, this operation returns a tensor with the diagonal and\n * everything else padded\n * with zeros.\n * Assume the input has dimensions `[D1,..., Dk]`, then the output is a tensor\n * of rank 2k with\n * dimensions `[D1,..., Dk, D1,..., Dk]`\n * `const x = tf.tensor1d([1, 2, 3, 4]);\n * tf.diag(x).print()\n * ``\n * `const x = tf.tensor1d([1, 2, 3, 4, 5, 6, 6, 8], [4, 2]);\n * tf.diag(x).print()\n * ``\n * @param x The\n * input tensor.\n */\nfunction diag_(x: Tensor): Tensor {\n  const $x = convertToTensor(x, 'x', 'diag');\n  const\n  inputs: DiagInputs = {x: $x};\n  return ENGINE.runKernel(Diag, inputs as {} as NamedTensorMap);\n}\n\nexport\nconst diag = op({diag_});\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *

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*\n\nimport {ENGINE} from './engine';\nimport {Dilation2D, Dilation2DAttrs, Dilation2DInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from\n './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the grayscale dilation over the input `x`.\n * @param x The input tensor, rank 3 or rank 4 of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch\n * of 1 is assumed.\n * @param filter The filter tensor, rank 3, of shape\n * `[filterHeight, filterWidth, depth]`.\n * @param strides The strides of the sliding window for each dimension of the\n * input tensor: `[strideHeight,\n * strideWidth]`. If `strides` is a single number,\n * then `strideHeight == strideWidth`. \n * @param pad The\n * type of padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of\n * filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1*1x1.\n * - For more\n * info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat Specify the data format of\n * the input and output data.\n * Defaults to 'NHWC'. Only 'NHWC' is currently supported. With the\n * default\n * format "NHWC", the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dilations\n * The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and\n * width dimensions\n * for atrous morphological dilation. Defaults to `[1, 1]`. If `dilations`\n * is a single\n * number, then `dilationHeight == dilationWidth`. If it is\n * greater than 1, then all values of `strides` must be 1.\n */\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction dilation2d_<T extends\n Tensor3D|Tensor4D>(\n  x: T|TensorLike, filter: Tensor3D|TensorLike,\n  strides: [number, number]|number,\n  pad: 'valid'|'same',\n  dilations: [number, number]|number = [1, 1],\n  dataFormat: 'NHWC' = 'NHWC'): T {\n  const $x = convertToTensor(x, 'x', 'dilation2d');\n  const $filter = convertToTensor(filter, 'filter', 'dilation2d');\n  util.assert(\n    $x.rank === 3 || $x.rank === 4,\n    () => `Error in dilation2d: input must be rank 3 or 4, but got\n rank ` +\n    `${$x.rank}`);\n  util.assert(\n    $filter.rank === 3,\n    () => `Error in dilation2d: filter must be\n rank 3, but got rank ` +\n    `${$filter.rank}`);\n  util.assert(\n    dataFormat === 'NHWC',\n    () => `Error in\n dilation2d: Only NHWC is currently supported, ` +\n    `but got dataFormat of ${dataFormat}`);\n  let x4D =\n $x as Tensor4D;\n  let reshapedTo4D = false;\n  if ($x.rank === 3) {\n    x4D = reshape($x, [1, $x.shape[0],\n $x.shape[1], $x.shape[2]]);\n    reshapedTo4D = true;\n  }\n  const inputs: Dilation2DInputs = {x: x4D, filter:\n $filter};\n  const attrs: Dilation2DAttrs = {strides, pad, dilations};\n  // tslint:disable-next-line: no-unnecessary-\n type-assertion\n  const res = ENGINE.runKernel(\n    Dilation2D, inputs as {} as NamedTensorMap,\n    attrs as {} as NamedAttrMap) as T;\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2],\n res.shape[3]]) as T;\n  }\n  return res;\n}\n\nexport const dilation2d = op({dilation2d_});\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the

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=====\n*/\n\n/**\n * Returns the dimensions in the input shape that are broadcasted to\n * produce the provided output shape.\n * The returned dimensions are 0-indexed and sorted. An example:\n * inShape = [4, 1, 3]\n * outShape = [5, 4, 3, 3]\n * result = [1]. Dimension 1 (2nd dimension of input) gets broadcasted 1 => 3.\n */\nexport function getBroadcastDims(\n  inShape: number[], outShape: number[]): number[] {\n  const inRank = inShape.length;\n  const dims: number[] = [];\n  for (let i = 0; i < inRank; i++) {\n    const dim = inRank - 1 - i;\n    const a = inShape[dim] || 1;\n    const b = outShape[outShape.length - 1 - i] || 1;\n    if (b > 1 && a === 1) {\n      dims.unshift(dim);\n    }\n  }\n  return dims;\n}\n\n/**\n * Returns the axes in the output space that should be reduced to produce\n * the input space.\n */\nexport function getReductionAxes(\n  inShape: number[], outShape: number[]): number[] {\n  const result: number[] = [];\n  for (let i = 0; i < outShape.length; i++) {\n    const inDim = inShape[inShape.length - i - 1];\n    const outAxis = outShape.length - i - 1;\n    const outDim = outShape[outAxis];\n    if (inDim === null || (inDim === 1 && outDim > 1)) {\n      result.unshift(outAxis);\n    }\n  }\n  return result;\n}\n\nexport function assertAndGetBroadcastShape(\n  shapeA: number[], shapeB: number[]): number[] {\n  const result: number[] = [];\n  const l = Math.max(shapeA.length, shapeB.length);\n  for (let i = 0; i < l; i++) {\n    let a = shapeA[shapeA.length - i - 1];\n    if (a === null) {\n      a = 1;\n    }\n    let b = shapeB[shapeB.length - i - 1];\n    if (b === null) {\n      b = 1;\n    }\n    if (a === 1) {\n      result.unshift(b);\n    } else if (b === 1) {\n      result.unshift(a);\n    } else if (a !== b) {\n      const errMsg = `Operands could not be broadcast together with shapes ` +\n        `${shapeA} and ${shapeB}`;\n      throw Error(errMsg);\n    } else {\n      result.unshift(a);\n    }\n  }\n  return result;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*/\n\nimport {ENGINE} from './engine';\nimport {Equal, EqualInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a == b) element-wise. Supports broadcasting.\n */\nexport function equal(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'equal');\n  let $b = convertToTensor(b, 'b', 'equal');\n  [$a, $b] = makeTypesMatch($a, $b);\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: EqualInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Equal, inputs as { } as NamedTensorMap);\n}\n\nexport const equal = op({equal_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {ENGINE} from './engine';\nimport {Select, SelectInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, assertShapesMatch} from
 './util';\nimport {broadcastTo} from './broadcast_to';\nimport {assertAndGetBroadcastShape} from
 './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the elements, either `a` or `b` depending on the
`condition`.\n * If the condition is true, select from `a`, otherwise select from `b`.\n * ```\n * const cond =
tf.tensor1d([false, false, true], 'bool');\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([-1, -2, -3]);\n *\n * a.where(cond, b).print();\n * ```\n * @param condition The input condition. Must be of dtype bool.\n *
@param a If `condition` is rank 1, `a` may have a higher rank but\n * its first dimension must match the size of
`condition`.\n * @param b A tensor with the same dtype as `a` and with shape that is\n * compatible with `a`.\n *
@return A tensor with same dtype as `a` and `b`, and shape that is\n * broadcastable from `a` and `b`.\n *\n *
@doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction where_<T extends Tensor>(\n condition:
Tensor|TensorLike, a: T|TensorLike, b: T|TensorLike): T {\n const $a = convertToTensor(a, 'a', 'where');\n const $b
= convertToTensor(b, 'b', 'where');\n const $condition = convertToTensor(condition, 'condition', 'where', 'bool');\n
// TODO: move this logic to forward function when the broadcastTo op is\n // implemented in WASM.\n // Find
the broadcastable shape for $a and $b.\n const broadcastShape = assertAndGetBroadcastShape($a.shape,
$b.shape);\n const $broadcastedA = broadcastTo($a, broadcastShape);\n const $broadcastedB = broadcastTo($b,
broadcastShape);\n if ($condition.rank === 1) {\n // If condition rank is 1, then the first dimension must match the
size of\n // condition.\n assert(\n $condition.shape[0] === $a.shape[0],\n () => 'The first dimension of
`a` must match the size of `condition`.');\n }\n if ($condition.rank !== 1) {\n // A must have the same shape as
condition.\n assertShapesMatch(\n $condition.shape, $broadcastedB.shape, 'Error in where: ');
}\n\n const
inputs: SelectInputs = {\n condition: $condition,\n t: $broadcastedA,\n e: $broadcastedB\n };\n return
ENGINE.runKernel(Select, inputs as unknown as NamedTensorMap);\n}\n\nexport const where =
op({where_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport {ENGINE} from './engine';\nimport {ZerosLike, ZerosLikeInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Creates a
`tf.Tensor` with all elements set to 0 with the same shape as the\n * given tensor.\n * ```\n * const x =
tf.tensor([1, 2]);\n * tf.zerosLike(x).print();\n * ```\n * @param x The tensor of required shape.\n *\n *
@doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction zerosLike_<T extends Tensor>(x: T|TensorLike): T {\n
const $x = convertToTensor(x, 'x', 'zerosLike');\n const inputs: ZerosLikeInputs = {x: $x};\n return
ENGINE.runKernel(ZerosLike, inputs as { } as NamedTensorMap);\n}\n\nexport const zerosLike =
op({zerosLike_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport {ENGINE} from './engine';\nimport {Elu, EluInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes exponential linear element-wise:  $x > 0 ? e^x - 1 : 0$ .\n *\n * const x = tf.tensor1d([-1, 1, -3, 2]);\n *\n * x.elu().print(); // or tf.elu(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction elu_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'elu');\n\n  const inputs: EluInputs = {x: $x};\n  return ENGINE.runKernel(Elu, inputs as {} as NamedTensorMap);\n}\n\nexport const elu = op({elu_});\n",/**\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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*\n\nimport {ENGINE} from './engine';\nimport {Erf, ErfInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes gauss error function of the input `tf.Tensor` element-wise:\n *  $erf(x)$ \n *\n * const x = tf.tensor1d([0, .1, -.1, .7]);\n *\n * x.erf().print(); // or tf.erf(x);\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction erf_<T extends Tensor>(x: T|TensorLike): T {\n  let $x = convertToTensor(x, 'x', 'erf');\n  util.assert($x.dtype === 'int32' || $x.dtype === 'float32',\n    () => 'Input dtype must be `int32` or `float32`.');\n\n  if ($x.dtype === 'int32') {\n    $x = cast($x, 'float32');\n  }\n\n  const inputs: ErfInputs = {x: $x};\n  return ENGINE.runKernel(Erf, inputs as {} as NamedTensorMap);\n}\n\nexport const erf = op({erf_});\n",/**\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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*\n\nimport {ENGINE} from './engine';\nimport {Exp, ExpInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes exponential of the input `tf.Tensor` element-wise:  $e^x$ \n *\n * const x = tf.tensor1d([1, 2, -3]);\n *\n * x.exp().print(); // or tf.exp(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction exp_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'exp');\n\n  const inputs: ExpInputs = {x: $x};\n  return ENGINE.runKernel(Exp, inputs as {} as NamedTensorMap);\n}\n\nexport const exp = op({exp_});\n",/**\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====
*\n\nimport {ENGINE} from './engine';\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Returns a
 `tf.Tensor` that has expanded rank, by inserting a dimension\n * into the tensor's shape.\n * \n * `js` \n * const x =
 tf.tensor1d([1, 2, 3, 4]);\n * const axis = 1;\n * x.expandDims(axis).print();\n * \n * \n * @param x The input
 tensor whose dimensions to be expanded.\n * @param axis The dimension index at which to insert shape of `1`.
 Defaults\n * to 0 (the first dimension).\n * \n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n
*\nfunction expandDims<T extends Tensor>(x: Tensor|TensorLike, axis = 0): T {\n const $x =
 convertToTensor(x, 'x', 'expandDims', 'string_or_numeric');\n\n util.assert(axis <= $x.rank, () => 'Axis must be <=
 rank of the tensor');\n\n const inputs: ExpandDimsInputs = {input: $x};\n const attrs: ExpandDimsAttrs = {dim:
 axis};\n\n return ENGINE.runKernel(\n ExpandDims, inputs as {} as NamedTensorMap, attrs as {} as
 NamedAttrMap);\n}\n\nexport const expandDims = op({expandDims_});\n\n"/**\n * @license\n * Copyright 2018
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport {ExpM1, ExpM1Inputs} from './kernel_names';\nimport {Tensor}
 from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
 exponential of the input `tf.Tensor` minus one element-wise.\n * \n * `e ^ x - 1`\n * \n * `js` \n * const x =
 tf.tensor1d([1, 2, -3]);\n * x.expM1().print(); // or tf.expM1(x)\n * \n * \n * @param x The input tensor.\n * \n *
 @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction expM1<T extends Tensor>(x: T|TensorLike): T {\n const $x =
 convertToTensor(x, 'x', 'expM1');\n\n const inputs: ExpM1Inputs = {x: $x};\n return ENGINE.runKernel(ExpM1,
 inputs as {} as NamedTensorMap);\n}\n\nexport const expM1 = op({expM1_});\n\n"/**\n * @license\n * Copyright
 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
 you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {ENGINE} from './engine';\nimport {Tile, TileAttrs, TileInputs} from './kernel_names';\nimport
 {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Construct a tensor by repeating it the number of
 times given by reps.\n * \n * This operation creates a new tensor by replicating `input` `reps`\n * times. The output
 tensor's i'th dimension has `input.shape[i]` * `reps[i]` elements, and the values of `input` are replicated\n *
 `reps[i]` times along the i'th dimension. For example, tiling\n * `[a, b, c, d]` by `[2]` produces `[a, b, c, d, a, b, c,
 d]`.\n * \n * `js` \n * const a = tf.tensor1d([1, 2]);\n * a.tile([2]).print(); // or a.tile([2])\n * \n * \n *
 @param x The tensor to tile.\n * @param reps Determines the number of replications per dimension.\n * \n *
 @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n *\nfunction tile<T extends Tensor>(x: T|TensorLike, reps:
 number[]): T {\n const $x = convertToTensor(x, 'x', 'tile', 'string_or_numeric');\n\n util.assert(\n $x.rank ===

```

```

reps.length,\n    () => `Error in transpose: rank of input ${x.rank}` +\n        `must match length of reps`
${reps}`);
\n\n const inputs: TileInputs = {x: $x};
\n\n const attrs: TileAttrs = {reps};
\n\n return
ENGINE.runKernel(\n    Tile, inputs as unknown as NamedTensorMap,\n    attrs as unknown as
NamedAttrMap);
\n\n\nexport const tile = op({tile_});
\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
*\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====
\n\n
*\n\nimport {Tensor2D} from '../tensor';
\n\nimport {DataType} from '../types';
\n\nimport {buffer} from
'/buffer';
\n\nimport {expandDims} from './expand_dims';
\n\nimport {op} from './operation';
\n\nimport {reshape} from
'/reshape';
\n\nimport {tile} from './tile';
\n\n/**\n * Create an identity matrix.\n *
*\n * @param numRows Number of
rows.\n * @param numColumns Number of columns. Defaults to `numRows`.\n * @param batchSize If provided,
will add the batch shape to the beginning\n * of the shape of the returned `tf.Tensor` by repeating the
identity\n * matrix.\n * @param dtype Data type.\n * @returns Identity matrix of the specified size and
data type, possibly\n * with batch repetition if `batchShape` is specified.\n *
*\n * @doc {heading: 'Tensors', subheading: 'Creation'}
\n\n
*\n\nfunction eye_(\n    numRows: number, numColumns?: number,\n    batchSize?:\n    [\n        number\n
    ] | [number, number] | [number, number, number] | [number, number, number, number],\n    dtype:
DataType =
'float32'): Tensor2D {\n    if (numColumns == null) {\n        numColumns = numRows;\n    }\n    const buff =
buffer([numRows, numColumns], dtype);\n    const n = numRows <= numColumns ? numRows : numColumns;\n
for (let i = 0; i < n; ++i) {\n        buff.set(1, i, i);\n    }\n    const out: Tensor2D =
reshape(buff.toTensor(), [numRows,
numColumns]);\n    if (batchShape == null) {\n        return out;\n    } else {\n        if
(batchShape.length === 1) {\n            return
tile(expandDims(out, 0), [batchShape[0], 1, 1]) as Tensor2D;\n        } else if
(batchShape.length === 2) {\n            //
tslint:disable-next-line:no-unnecessary-type-assertion\n            return tile(\n                expandDims(expandDims(out, 0),
0),\n                [batchShape[0], batchShape[1], 1, 1]) as Tensor2D;\n        } else if
(batchShape.length === 3) {\n            //
tslint:disable-next-line:no-unnecessary-type-assertion\n            return tile(expandDims(expandDims(expandDims(out,
0), 0), 0), [\n                batchSize[0], batchSize[1], batchSize[2], 1, 1\n            ]) as
Tensor2D;\n        } else {\n            throw new Error(\n                `eye() currently supports only 1D and 2D` +\n                `// tslint:disable-next-line:no-any`\n                `batchShapes, but received
${(batchShape as any).length}D.`);\n        }\n    }\n}\n\n\nexport const eye =
op({eye_});
\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
*\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
\n\n
=====
\n\n
*\n\nimport {ENGINE} from '../engine';
\n\nimport {Fill, FillAttrs} from './kernel_names';
\n\nimport {NamedAttrMap}
from './kernel_registry';
\n\nimport {Tensor} from '../tensor';
\n\nimport {DataType, Rank, ShapeMap} from
'../types';
\n\n/**\n * Creates a `tf.Tensor` filled with a scalar value.\n *
*\n * @param shape An array of integers defining the output tensor shape.\n * @param value The scalar
value to fill the tensor with.\n * @param dtype The type of an element in the resulting tensor. Defaults to\n *
`float`.\n *
*\n * @doc {heading: 'Tensors', subheading: 'Creation'}
\n\n
*\n\nfunction fill<R extends Rank>(\n    shape: ShapeMap[R],
value: number|string, dtype?:
DataType): Tensor<R> {\n    const attrs: FillAttrs = {shape, value, dtype};\n    return
ENGINE.runKernel(Fill, {}, attrs as {} as NamedAttrMap);
\n\n\n\nexport {fill};
\n\n", "/*\n * @license\n * Copyright\n * 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *

```

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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Floor, FloorInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes floor of input `tf.Tensor` element-wise: `floor(x)`.\n *\n * `js`\n * const x = tf.tensor1d([.6, 1.1, -3.3]);\n *\n * x.floor().print(); // or tf.floor(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction floor<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'floor');\n\n  const inputs: FloorInputs = {x: $x};\n  return ENGINE.runKernel(Floor, inputs as { } as NamedTensorMap);\n}\n\nexport const floor = op({floor_});\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {GatherV2, GatherV2Attrs, GatherV2Inputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Gather slices from tensor `x`'s axis `axis` according to `indices`.\n *\n * `js`\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const indices = tf.tensor1d([1, 3, 3], 'int32');\n *\n * x.gather(indices).print();\n *\n * `js`\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const indices = tf.tensor1d([1, 1, 0], 'int32');\n *\n * x.gather(indices).print();\n *\n * @param x The input tensor whose slices to be gathered.\n * @param indices The indices of the values to extract.\n * @param axis The axis over which to select values. Defaults to 0.\n * @param batchDims Optional. The number of batch dimensions. It must be less\n * than or equal to rank(indices). Defaults to 0.\n * The output tensor will have shape of\n * `x.shape[:axis] + indices.shape[batchDims:] + x.shape[axis + 1:]`\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction gather<T extends Tensor>(x: T|TensorLike, indices: Tensor|TensorLike, axis = 0, batchDims = 0): T {\n  const $x = convertToTensor(x, 'x', 'gather');\n  const $indices = convertToTensor(indices, 'indices', 'gather', 'int32');\n\n  const inputs: GatherV2Inputs = {x: $x, indices: $indices};\n  const attrs: GatherV2Attrs = {axis, batchDims};\n\n  return ENGINE.runKernel(GatherV2, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const gather = op({gather_});\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Greater, GreaterInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth
```


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```
=====
*\n\nimport {ENGINE} from './engine';\nimport {IsFinite, IsFiniteInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are finite.\n *\n * ```js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * x.isFinite().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction isFinite_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isFinite');\n  const inputs: IsFiniteInputs = {x: $x};\n  return ENGINE.runKernel(IsFinite, inputs as { } as NamedTensorMap);\n}\n\nexport const isFinite = op({isFinite_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====
*\n\nimport {ENGINE} from './engine';\nimport {IsInf, IsInfInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are Infinity or -Infinity.\n *\n * ```js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * x.isInf().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction isInf_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isInf');\n  const inputs: IsInfInputs = {x: $x};\n  return ENGINE.runKernel(IsInf, inputs as { } as NamedTensorMap);\n}\n\nexport const isInf = op({isInf_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====
*\n\nimport {ENGINE} from './engine';\nimport {IsNaN, IsNaNInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns which elements of x are NaN.\n *\n * ```js\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * x.isNaN().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction isNaN_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isNaN');\n  const inputs: IsNaNInputs = {x: $x};\n  return ENGINE.runKernel(IsNaN, inputs as { } as NamedTensorMap);\n}\n\nexport const isNaN = op({isNaN_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n */\n
```



```

makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs:
LessEqualInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(LessEqual, inputs as { } as
NamedTensorMap);\n\n\nexport const lessEqual = op({lessEqual_});\n\n", "/*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {LinSpace, LinSpaceAttrs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\n\n/*\n * Return an evenly spaced
sequence of numbers over the given interval.\n * \n * ``js\n * tf.linspace(0, 9, 10).print();\n * ``\n * @param start
The start value of the sequence.\n * @param stop The end value of the sequence.\n * @param num The number of
values to generate.\n * \n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nexport function linspace(start:
number, stop: number, num: number): Tensor1D {\n  if (num <= 0) {\n    throw new Error("The number of values
should be positive.");\n  }\n\n  const attrs: LinSpaceAttrs = {start, stop, num};\n  return
ENGINE.runKernel(LinSpace, { }, attrs as { } as NamedAttrMap);\n\n}\n\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {LRN, LRNAttrs, LRNInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {reshape}
from './reshape';\n\n/*\n * Normalizes the activation of a local neighborhood across or within\n * channels.\n * \n *
@param x The input tensor. The 4-D input tensor is treated as a 3-D array\n *   of 1D vectors (along the last
dimension), and each vector is\n *   normalized independently.\n * @param depthRadius The number of adjacent
channels in the 1D normalization\n *   window.\n * @param bias A constant bias term for the basis.\n * @param
alpha A scale factor, usually positive.\n * @param beta An exponent.\n * \n * @doc {heading: 'Operations',
subheading: 'Normalization'}\n *\nfunction localResponseNormalization_<T extends Tensor3D|Tensor4D>(\n  x:
T|TensorLike, depthRadius = 5, bias = 1, alpha = 1, beta = 0.5): T {\n  const $x = convertToTensor(x, 'x',
'localResponseNormalization');\n  util.assert(\n    $x.rank === 4 || $x.rank === 3,\n    () => `Error in
localResponseNormalization: x must be rank 3 or 4 but got\n      rank ${$x.rank}.`);\n  util.assert(\n
util.isInt(depthRadius),\n    () => `Error in localResponseNormalization: depthRadius must be an ` +\n
`integer but got depthRadius ${depthRadius}.`);\n  let x4D = $x as Tensor4D;\n  let reshapedTo4D = false;\n  if
($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n
  }\n\n  const inputs: LRNInputs = {x: x4D};\n  const attrs: LRNAttrs = {depthRadius, bias, alpha, beta};\n\n  //
tslint:disable-next-line: no-unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n    LRN, inputs
as { } as NamedTensorMap,\n    attrs as { } as NamedAttrMap) as T;\n\n  if (reshapedTo4D) {\n    return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n  } else {\n    return res;\n  }\n\n\nexport const
localResponseNormalization = op({localResponseNormalization_});\n\n", "/*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

```

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```
=====\n *\n\nimport {ENGINE} from './engine';\nimport {Log, LogInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes natural logarithm of the input `tf.Tensor` element-wise: `ln(x)`\n *  
js\n * const x = tf.tensor1d([1, 2, Math.E]);\n * x.log().print(); // or tf.log(x)\n *  
@param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction log<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'log');\n  const inputs: LogInputs = {x: $x};\n  return ENGINE.runKernel(Log, inputs as { } as NamedTensorMap);\n}\n\nexport const log = op({log_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
```

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```
=====\n *\n\nimport {ENGINE} from './engine';\nimport {Log1p, Log1pInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes natural logarithm of the input `tf.Tensor` plus one\n * element-wise: `ln(1 + x)`\n *  
js\n * const x = tf.tensor1d([1, 2, Math.E - 1]);\n * x.log1p().print(); // or tf.log1p(x)\n *  
@param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction log1p<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'log1p');\n  const inputs: Log1pInputs = {x: $x};\n  return ENGINE.runKernel(Log1p, inputs as { } as NamedTensorMap);\n}\n\nexport const log1p = op({log1p_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *
```

```
=====\n *\n\nimport {CustomGradientFunc, ENGINE} from './engine';\nimport {Scalar, Tensor, Variable} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor, convertToTensorArray} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\n/**\n * Provided `f(x)`, returns another function `g(x, dy?)`, which gives the\n * gradient of `f(x)` with respect to `x`. If `dy` is provided, the gradient of `f(x).mul(dy).sum()` with respect to\n * `x` is computed instead. `f(x)` must take a single tensor `x` and return a\n * single tensor `y`. If `f()` takes multiple inputs, use `tf.grads` instead.\n *  
js\n * // f(x) = x ^ 2\n * const f = x => x.square();\n * // f(x) = 2x\n * const g = tf.grad(f);\n * const x = tf.tensor1d([2, 3]);\n * g(x).print();\n *  
js\n * // f(x) = x ^ 3\n * const f = x => x.pow(tf.scalar(3, 'int32'));\n * // f'(x) = 3x ^ 2\n * const g = tf.grad(f);\n * // f''(x) = 6x\n * const gg = tf.grad(g);\n * const x = tf.tensor1d([2, 3]);\n * gg(x).print();\n *  
@param f The function f(x), to compute gradient for.\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n */\nfunction grad(f: (x: Tensor) => Tensor): (\n  x: TensorLike|Tensor, dy?:\n  TensorLike|Tensor) => Tensor {\n  util.assert(\n    util.isFunction(f), () => \"The f passed in grad(f) must be a function\");\n  return (x: TensorLike|Tensor, dy?: TensorLike|Tensor): Tensor => {\n    // x can be of any dtype, thus\n  }\n}
```



```

implementation.\n // There is no LogSigmoid kernel in TF so we can't use engine.runKernel\n // directly\n const
customOp = customGrad((x: Tensor) => {\n // TODO(yassogba) we can remove the chained softplus call here
only\n // after backends have modularized softplus at which point we can call\n // engine runKernel(..., Softplus,
...) directly.\n const value = neg(softplus(neg(x)));;\n\n const gradFunc = (dy: T) => {\n const derX = mul(dy,
sigmoid(neg(x)));;\n return derX;\n };;\n return {value, gradFunc};;\n });;\n\n return customOp($x) as
T;\n}\n\nexport const logSigmoid = op({logSigmoid_});;\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Max, MaxAttrs, MaxInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';;\n\n/*\n * Computes the maximum of elements across dimensions of a
`tf.Tensor`.\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are
retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single
element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n * x.max().print(); // or tf.max(x)\n * ```\n
*\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.max(axis).print(); // or tf.max(x,
axis)\n * ```\n *\n * @param x The input tensor.\n * @param axis The dimension(s) to reduce. By default it
reduces\n * all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n *\n * @doc
{heading: 'Operations', subheading: 'Reduction'}\n *\nfunction max_<T extends Tensor>(\n x:
Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const $x = convertToTensor(x, 'x',
'max');;\n\n const inputs: MaxInputs = {x: $x};;\n const attrs: MaxAttrs = {reductionIndices: axis, keepDims};;\n\n
return ENGINE.runKernel(\n Max, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);\n}\n\nexport const max = op({max_});;\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Sub, SubInputs} from './kernel_names';\nimport {Tensor} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{op} from './operation';;\n\n/*\n * Subtracts two `tf.Tensor`s element-wise, A - B. Supports broadcasting.\n *\n *
```js\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n * a.sub(b).print(); // or
tf.sub(a, b)\n * ```\n *\n * ```js\n * // Broadcast subtract a with b.\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const
b = tf.scalar(5);\n * a.sub(b).print(); // or tf.sub(a, b)\n * ```\n *\n * @param a The first `tf.Tensor` to subtract
from.\n * @param b The second `tf.Tensor` to be subtracted. Must have the same dtype as\n * `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Arithmetic'}\n *\nfunction sub_<T extends Tensor>(a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'sub');;\n let $b = convertToTensor(b, 'b', 'sub');;\n [$a,
$b] = makeTypesMatch($a, $b);\n\n const inputs: SubInputs = {a: $a, b: $b};;\n\n return ENGINE.runKernel(Sub,
inputs as {} as NamedTensorMap);\n}\n\nexport const sub = op({sub_});;\n", "/*\n * @license\n * Copyright 2018

```



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```
=====\n\n *\\nimport {ENGINE} from './engine';\\nimport {Sum, SumAttrs, SumInputs} from './kernel_names';\\nimport {NamedAttrMap} from './kernel_registry';\\nimport {Tensor} from './tensor';\\nimport {NamedTensorMap} from './tensor_types';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from './types';\\nimport {cast} from './cast';\\nimport {op} from './operation';\\n\\n/**\\n * Computes the sum of elements across dimensions of a `tf.Tensor`.\\n *\\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\\n * is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with length 1. If axes has no entries, all dimensions are reduced, and a `tf.Tensor` with a single element is returned.\\n *\\n * ```js\\n * const x = tf.tensor1d([1, 2, 3]);\\n * x.sum().print();\\n * // or tf.sum(x)\\n * ```\\n * \\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\\n * const axis = 1;\\n * x.sum(axis).print(); // or tf.sum(x, axis)\\n * ```\\n * \\n * @param x The input tensor to compute the sum over. If the dtype is `bool` it will be converted to `int32` and the output dtype will be `int32`.\\n * @param axis The dimension(s) to reduce. By default it reduces all dimensions.\\n * @param keepDims If true, retains reduced dimensions with size 1.\\n * @doc {heading: 'Operations', subheading: 'Reduction'}\\n */\\nfunction sum_<T extends Tensor>(x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\\n let $x = convertToTensor(x, 'x', 'sum');\\n if ($x.dtype === 'bool') {\\n $x = cast($x, 'int32');\\n }\\n const inputs: SumInputs = {x: $x};\\n const attrs: SumAttrs = {axis, keepDims};\\n return ENGINE.runKernel(\\n Sum, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\\n}\\n\\nexport const sum = op({sum_});\\n", "/**\\n * @license\\n * Copyright 2020 Google Inc. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\nimport {customGrad} from './gradients';\\nimport {Tensor} from './tensor';\\nimport {GradSaveFunc} from './tensor_types';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from './types';\\nimport {cast} from './cast';\\nimport {exp} from './exp';\\nimport {log} from './log';\\nimport {max} from './max';\\nimport {mul} from './mul';\\nimport {op} from './operation';\\nimport {sub} from './sub';\\nimport {sum} from './sum';\\n\\n/**\\n * Computes the log softmax.\\n *\\n * ```js\\n * const a = tf.tensor1d([1, 2, 3]);\\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\\n * ```\\n * \\n * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);\\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\\n * ```\\n * \\n * @param logits The logits array.\\n * @param axis The dimension softmax would be performed on. Defaults to -1 which indicates the last dimension.\\n * \\n * @doc {heading: 'Operations', subheading: 'Normalization'}\\n */\\nfunction logSoftmax_<T extends Tensor>(logits: T|TensorLike, axis = -1): T {\\n const $logits = convertToTensor(logits, 'logits', 'logSoftmax');\\n if (axis === -1) {\\n axis = $logits.rank - 1;\\n }\\n if (axis !== $logits.rank - 1) {\\n throw Error(\\n `Log Softmax along a non-last dimension is not yet supported. ` +\\n `Logits was rank ${$logits.rank} and axis was ${axis}`);\\n }\\n // const forward: ForwardFunc<Tensor> = (backend, save) => {\\n // const keepDims = true;\\n // const xMax = max(logits, axis, true);\\n // const shifted = sub(logits, xMax);\\n // const value = sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis, keepDims)));\\n // save([value]);\\n // return value;\\n // };\\n // Use a custom gradient for numerical stability.\\n const customOp = customGrad((logits: Tensor, save: GradSaveFunc) => {\\n const keepDims = true;\\n const xMax = max(logits, axis, true);\\n const shifted =
```



```

{expandShapeToKeepDim} from './axis_util';\nimport {exp} from './exp';\nimport {log} from './log';\nimport {max}
from './max';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {sub} from
'/sub';\nimport {sum} from './sum';\n\n/**\n * Computes the log(sum(exp(elements across the reduction
dimensions)).\n *\n * Reduces the input along the dimensions given in `axis`. Unless `keepDims`\n * is true, the
rank of the array is reduced by 1 for each entry in `axis`.\n *\n * If `keepDims` is true, the reduced dimensions are
retained with length 1.\n *\n * If `axis` has no entries, all dimensions are reduced, and an array with a\n * single element
is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n * x.logSumExp().print(); // or tf.logSumExp(x)\n *
```\n *\n * ```js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.logSumExp(axis).print(); //
or tf.logSumExp(a, axis)\n * ```\n * @param x The input tensor.\n * @param axis The dimension(s) to reduce. If
null (the default),\n * reduces all dimensions.\n * @param keepDims If true, retains reduced dimensions with
length\n * of 1. Defaults to false.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n *\nfunction
logSumExp_<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n
const $x = convertToTensor(x, 'x', 'logSumExp');\n\n const axes = parseAxisParam(axis, $x.shape);\n const xMax
= max($x, axes, true /* keepDims */);\n const a = sub($x, xMax);\n const b = exp(a);\n const c = sum(b, axes);\n
const d = log(c);\n const res = add(reshape(xMax, d.shape), d);\n\n if (keepDims) {\n const newShape =
expandShapeToKeepDim(res.shape, axes);\n return reshape(res, newShape) as T; }\n\n return res as
T; }\n\nexport const logSumExp = op({logSumExp_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {ENGINE} from './engine';\nimport {LogicalAnd, LogicalAndInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {assertAndGetBroadcastShape} from
'/broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of `a AND b` element-wise.
Supports broadcasting.\n *\n * ```js\n * const a = tf.tensor1d([false, false, true, true], 'bool');\n * const b =
tf.tensor1d([false, true, false, true], 'bool');\n * a.logicalAnd(b).print();\n * ```\n *\n * @param a The first input
tensor. Must be of dtype bool.\n * @param b The second input tensor. Must be of dtype bool.\n *\n * @doc
{heading: 'Operations', subheading: 'Logical'}\n *\nfunction logicalAnd_<T extends Tensor>(\n  a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n const $a = convertToTensor(a, 'a', 'logicalAnd', 'bool');\n const $b
= convertToTensor(b, 'b', 'logicalAnd', 'bool');\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const
inputs: LogicalAndInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(LogicalAnd, inputs as { } as
NamedTensorMap);\n}\n\nexport const logicalAnd = op({logicalAnd_});\n", "/*\n * @license\n * Copyright 2020
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {ENGINE} from './engine';\nimport {LogicalNot, LogicalNotInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns the
truth value of `NOT x` element-wise.\n *\n * ```js\n * const a = tf.tensor1d([false, true], 'bool');\n *\n *
a.logicalNot().print();\n * ```\n *\n * @param x The input tensor. Must be of dtype 'bool'. \n *\n * @doc {heading:

```

```
'Operations', subheading: 'Logical')\n *\nfunction logicalNot_<T extends Tensor>(x: T|TensorLike): T {\n const\n $x = convertToTensor(x, 'x', 'logicalNot', 'bool');\n const inputs: LogicalNotInputs = {x: $x};\n return\n ENGINE.runKernel(LogicalNot, inputs as {} as NamedTensorMap);\n}\n\nexport const logicalNot =\n op({logicalNot_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {LogicalOr, LogicalOrInputs} from './kernel_names';\nimport\n {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from\n './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of `a OR b` element-wise.\n Supports broadcasting.\n *\n * ``js\n * const a = tf.tensor1d([false, false, true, true], 'bool');\n * const b =\n tf.tensor1d([false, true, false, true], 'bool');\n * a.logicalOr(b).print();\n * ``\n * @param a The first input tensor.\n Must be of dtype bool.\n * @param b The second input tensor. Must be of dtype bool.\n *\n * @doc {heading:\n 'Operations', subheading: 'Logical'}\n *\nfunction logicalOr_<T extends Tensor>(a: Tensor|TensorLike, b:\n Tensor|TensorLike): T {\n const $a = convertToTensor(a, 'a', 'logicalOr', 'bool');\n const $b = convertToTensor(b,\n 'b', 'logicalOr', 'bool');\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: LogicalOrInputs = {a:\n $a, b: $b};\n return ENGINE.runKernel(LogicalOr, inputs as {} as NamedTensorMap);\n}\n\nexport const logicalOr\n = op({logicalOr_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}\n from './types';\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {logicalAnd} from\n './logical_and';\nimport {logicalNot} from './logical_not';\nimport {logicalOr} from './logical_or';\nimport {op} from\n './operation';\n\n/**\n * Returns the truth value of `a XOR b` element-wise. Supports broadcasting.\n *\n * ``js\n * const a = tf.tensor1d([false, false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true], 'bool');\n *\n * a.logicalXor(b).print();\n * ``\n * @param a The first input tensor. Must be of dtype bool.\n * @param b The\n second input tensor. Must be of dtype bool.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction logicalXor_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n const $a =\n convertToTensor(a, 'a', 'logicalXor', 'bool');\n const $b = convertToTensor(b, 'b', 'logicalXor', 'bool');\n assertAndGetBroadcastShape($a.shape, $b.shape);\n // x ^ y = (x | y) & ~(x & y)\n return\n logicalAnd(logicalOr(a, b), logicalNot(logicalAnd(a, b)));\n}\n\nexport const logicalXor =\n op({logicalXor_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {MaxPool, MaxPoolAttrs, MaxPoolInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport * as conv_util
 from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the 2D
 max pooling of an image.\n * @param x The input tensor, of rank 4 or rank 3 of shape\n *   `[batch, height,
 width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: `[filterHeight,
 filterWidth]`. If\n *   `filterSize` is a single number, then `filterHeight == filterWidth`.\n * @param strides The
 strides of the pooling: `[strideHeight, strideWidth]`. If\n *   `strides` is a single number, then `strideHeight ==
 strideWidth`.\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n *   in which we sample
 input values across the height and width dimensions\n *   in dilated pooling. Defaults to `[1, 1]`. If `dilations` is a
 single\n *   number, then `dilationHeight == dilationWidth`. If it is greater than\n *   1, then all values of `strides`
 must be 1.\n * @param pad The type of padding algorithm.\n *   - `same` and stride 1: output will be of same size
 as input,\n *   regardless of filter size.\n *   - `valid`: output will be smaller than input if filter is larger\n *
 than 1x1.\n *   - For more info, see this guide:\n *
 [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
 https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dimRoundingMode A string from:
 'ceil', 'round', 'floor'. If none is\n *   provided, it will default to truncate.\n *\nfunction maxPool<T> extends
 Tensor3D|Tensor4D>(\n  x: T|TensorLike, filterSize: [number, number]|number,\n  strides: [number,
 number]|number, pad: 'valid'|'same'|number,\n  dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n  const $x =
 convertToTensor(x, 'x', 'maxPool');\n  const dilations = 1;\n  let x4D = $x as Tensor4D;\n  let reshapedTo4D =
 false;\n  if ($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x, [1, $x.shape[0], $x.shape[1],
 $x.shape[2]]);\n  }\n  util.assert(\n    x4D.rank === 4,\n    () => `Error in maxPool: input must be rank 4 but got
 rank ${x4D.rank}.`);\n  util.assert(\n    conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n    () =>
 `Error in maxPool: Either strides or dilations must be 1. ` +\n    `Got strides ${strides} and dilations
 ${dilations}`);\n  if (dimRoundingMode != null) {\n    util.assert(\n      util.isInt(pad as number),\n      () =>
 `Error in maxPool: pad must be an integer when using, ` +\n      `dimRoundingMode ${dimRoundingMode} but
 got pad ${pad}.`);\n  }\n  const inputs: MaxPoolInputs = {x: x4D};\n  const attrs: MaxPoolAttrs = {filterSize,
 strides, pad, dimRoundingMode};\n  // tslint:disable-next-line: no-unnecessary-type-assertion\n  const res =
 ENGINE.runKernel(\n    MaxPool, inputs as {} as NamedTensorMap,\n    attrs as {} as
 NamedAttrMap) as T;\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
 T;\n  }\n  return res;\n}\n\nexport const maxPool = op({maxPool_});\n\n"/**\n * @license\n * Copyright 2020
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from
 './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the 3D max pooling.\n * @param x The input
 tensor, of rank 5 or rank 4 of shape\n *   `[batch, depth, height, width, inChannels]`.\n * @param filterSize The
 filter size:\n *   `[filterDepth, filterHeight, filterWidth]`. If

```

`filterSize` is a single number, then filterDepth == filterHeight == filterWidth`.`

`@param strides` The strides of the pooling: `[strideDepth, strideHeight, strideWidth]`. If `strides`` is a single number, then `strideDepth == strideHeight == strideWidth`.`

`@param pad` The type of padding algorithm. - `same`` and stride 1: output will be of same size as input, regardless of filter size. - `valid``: output will be smaller than input if filter is larger than 1x1x1. - For more info, see this guide: https://www.tensorflow.org/api_guides/python/nn#Convolution

`@param dimRoundingMode` A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.

`@param dataFormat` An optional string from: `"NDHWC"`, `"NCDHW"`. Defaults to `"NDHWC"`. Specify the data format of the input and output data. With the default format `"NDHWC"`, the data is stored in the order of: [batch, depth, height, width, channels]. Only `"NDHWC"` is currently supported.

`@doc {heading: 'Operations', subheading: 'Convolution'}`

```

def maxPool3d<T extends Tensor4D|Tensor5D>(x: T|TensorLike, filterSize: [number, number, number], number = [1, 1, 1], strides: [number, number, number], number, pad: 'valid'|'same'|number, dimRoundingMode?: 'floor'|'round'|'ceil', dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {
  const $x = convertToTensor(x, 'x', 'maxPool3d');
  let x5D = $x as Tensor5D;
  let reshapedTo5D = false;
  if ($x.rank === 4) {
    reshapedTo5D = true;
    x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);
  }
  util.assert(x5D.rank === 5, () => `Error in maxPool3d: x must be rank 5 but got rank ${x5D.rank}.`);
  util.assert(dataFormat === 'NDHWC', () => `Error in maxPool3d: Only NDHWC is currently supported, ` + `but got dataFormat of ${dataFormat}`);
  if (dimRoundingMode != null) {
    util.assert(util.isInt(pad as number), () => `Error in maxPool3d: pad must be an integer when using, ` + `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
  }
  const inputs: MaxPool3DInputs = {x: x5D};
  const attrs: MaxPool3DAttrs = {filterSize, strides, pad, dimRoundingMode, dataFormat};
  // tslint:disable-next-line: no-unnecessary-type-assertion
  const res = ENGINE.runKernel(MaxPool3D, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as T;
  if (reshapedTo5D) {
    return reshape(res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as T;
  }
  return res;
}
export const maxPool3d = op({maxPool3d});

```

`op({maxPool3d});`

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```

import {ENGINE} from '../engine';
import {MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor, Tensor4D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from '../operation';

/**
 * Computes the 2D max pooling of an image with Argmax index.
 * The indices in argmax are flattened, so that a maximum value at position [b, y, x, c] becomes flattened index: (y * width + x) * channels + c` if include_batch_in_index` is False; ((b * height + y) * width + x) * channels + c` if include_batch_in_index` is True.
 * The indices returned are always in [0, height) x [0, width)` before flattening.
 * @param x The input tensor, of rank 4 or rank 3 of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.
 * @param filterSize The filter size: [filterHeight, filterWidth]. If filterSize` is a single number, then filterHeight == filterWidth`.
 * @param strides The strides of the pooling: [strideHeight, strideWidth]. If strides` is a single number, then strideHeight == strideWidth`.
 * @param dataFormat An optional string from: "NDHWC", "NCDHW". Defaults to "NDHWC". Specify the data format of the input and output data. With the default format "NDHWC", the data is stored in the

```

```

order of: [batch,\n * depth, height, width, channels]. Only \"NDHWC\" is currently supported.\n * @param pad
The type of padding algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of
filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n * - For more info,
see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param includeBatchIndex Defaults to False.
Whether to include batch\n * dimension in flattened index of argmax.\n * \n * @doc {heading: 'Operations',
subheading: 'Convolution'}\n * \nfunction maxPoolWithArgmax_<T extends Tensor4D>(\n * x: T|TensorLike,
filterSize: [number, number]|number,\n * strides: [number, number]|number, pad: 'valid'|'same'|number,\n
includeBatchInIndex = false): NamedTensorMap {\n * const $x = convertToTensor(x, 'x',
'maxPoolWithArgmax');\n * \n * const inputs: MaxPoolWithArgmaxInputs = {x: $x};\n * const attrs:\n
MaxPoolWithArgmaxAttrs = {filterSize, strides, pad, includeBatchInIndex};\n * \n // tslint:disable-next-line: no-
unnecessary-type-assertion\n * const result = ENGINE.runKernel(\n * MaxPoolWithArgmax, inputs as {
as NamedTensorMap,\n * attrs as { } as NamedAttrMap) as Tensor[];\n * \n return {result: result[0],
indexes: result[1]};\n * \n}\n * \nexport const maxPoolWithArgmax = op({maxPoolWithArgmax_});\n * \n"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n *\nimport {ENGINE} from './engine';\nimport {Maximum, MaximumInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {cast} from './cast';\nimport {op} from
'./operation';\n\n/**\n * Returns the max of a and b (a > b ? a : b) element-wise.\n * Supports broadcasting.\n * \n *
We also expose `tf.maximumStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the
same shape (does not broadcast).\n * \n * ```js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2,
9, 4]);\n * \n * a.maximum(b).print(); // or tf.maximum(a, b)\n * \n * ```\n * \n * // Broadcast maximum a with
b.\n * \n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n * \n * a.maximum(b).print(); // or tf.maximum(a,
b)\n * \n * ```\n * \n * @param a The first tensor.\n * @param b The second tensor. Must have the same type as `a`.\n *
\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n * \nfunction maximum_<T extends Tensor>(\n * a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n * let $a = convertToTensor(a, 'a', 'maximum');\n * let $b =
convertToTensor(b, 'b', 'maximum');\n * [$a, $b] = makeTypesMatch($a, $b);\n * \n if ($a.dtype === 'bool') {\n * $a =
cast($a, 'int32');\n * $b = cast($b, 'int32');\n * }\n * \n assertAndGetBroadcastShape($a.shape, $b.shape);\n * \n const
inputs: MaximumInputs = {a: $a, b: $b};\n * \n return ENGINE.runKernel(Maximum, inputs as { } as
NamedTensorMap);\n * \n}\n * \nexport const maximum = op({maximum_});\n * \n"/**\n * @license\n * Copyright 2020
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n *\nimport {ENGINE} from './engine';\nimport {Mean, MeanAttrs, MeanInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes the mean of elements across dimensions of a

```

```

`tf.Tensor`.  

`tf.Tensor` along the dimensions given in `axis`. Unless `keepDims` is true, the rank of the  

`tf.Tensor` is reduced by 1 for each entry in `axis`. If `keepDims` is true, the reduced dimensions are retained  

with length 1. If `axis` has no entries, all dimensions are reduced, and a `tf.Tensor` with a single element is  

returned.  

js const x = tf.tensor1d([1, 2, 3]); x.mean().print(); // or tf.mean(a) js const x =  

tf.tensor2d([1, 2, 3, 4], [2, 2]); const axis = 1; x.mean(axis).print(); // or tf.mean(x,  

axis)  

@param x The input tensor.  

@param axis The dimension(s) to reduce. By default it reduces all dimensions.  

@param keepDims If true, retains reduced dimensions with size 1.  

@doc {heading: 'Operations', subheading: 'Reduction'}  

function mean_<T extends Tensor>(x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {  

  const $x = convertToTensor(x, 'x', 'mean');  

  const inputs: MeanInputs = {x: $x};  

  const attrs: MeanAttrs = {axis, keepDims};  

  return ENGINE.runKernel(Mean, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);  

} export const mean = op({mean_});  

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http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing,  

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OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language  

governing permissions and limitations under the License.

```

```

=====
import {ENGINE} from './engine'; import {Min, MinAttrs, MinInputs} from './kernel_names'; import  

{NamedAttrMap} from './kernel_registry'; import {Tensor} from './tensor'; import {NamedTensorMap} from  

 './tensor_types'; import {convertToTensor} from './tensor_util_env'; import {TensorLike} from  

 './types'; import {op} from './operation';  

/** Computes the minimum value from the input.  

Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the array is  

reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with length 1.  

If `axes` has no entries, all dimensions are reduced, and an array with a single element is returned.  

js const x = tf.tensor1d([1, 2, 3]); x.min().print(); // or tf.min(x) js const x =  

tf.tensor2d([1, 2, 3, 4], [2, 2]); const axis = 1; x.min(axis).print(); // or tf.min(x, axis)  

@param x The input Tensor.  

@param axis The dimension(s) to reduce. By default it reduces all dimensions.  

@param keepDims If true, retains reduced dimensions with size 1.  

@doc {heading: 'Operations', subheading: 'Reduction'}  

function min_<T extends Tensor>(x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {  

  const $x = convertToTensor(x, 'x', 'min');  

  const inputs: MinInputs = {x: $x};  

  const attrs: MinAttrs = {axis, keepDims};  

  // tslint:disable-next-line: no-unnecessary-type-assertion  

  return ENGINE.runKernel(Min, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as T;  

} export const min = op({min_});  

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http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing,  

software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES  

OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language  

governing permissions and limitations under the License.

```

```

=====
import {ENGINE} from './engine'; import {Minimum, MinimumInputs} from './kernel_names'; import  

{Tensor} from './tensor'; import {NamedTensorMap} from './tensor_types'; import {makeTypesMatch} from  

 './tensor_util'; import {convertToTensor} from './tensor_util_env'; import {TensorLike} from './types';  

import {assertAndGetBroadcastShape} from './broadcast_util'; import {cast} from './cast'; import {op} from  

 './operation';  

/** Returns the min of a and b (a < b ? a : b) element-wise. Supports broadcasting.  

We also expose `minimumStrict` which has the same signature as this op and asserts that `a` and `b` are the

```


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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Mod, ModInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Returns the mod of a and b element-wise.\n *  $\text{floor}(x / y) * y + \text{mod}(x, y) = x$ \n * Supports broadcasting.\n * We also expose `tf.modStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the same shape (does not broadcast).\n * js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n * a.mod(b).print(); // or tf.mod(a, b)\n * js\n * // Broadcast a mod b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n * a.mod(b).print(); // or tf.mod(a, b)\n * js\n * @param a The first tensor.\n * @param b The second tensor. Must have the same type as `a`.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction mod_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a', 'mod');\n  let $b = convertToTensor(b, 'b', 'mod');\n  [$a, $b] = makeTypesMatch($a, $b);\n  const inputs: ModInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Mod, inputs as { }) as NamedTensorMap;\n}\n\nexport const mod = op({mod_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes square of `x` element-wise:  $x^2$ \n * js\n * const x = tf.tensor1d([1, 2, Math.sqrt(2), -1]);\n * x.square().print(); // or tf.square(x)\n * js\n * @param x The input Tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction square_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'square');\n  const attrs = {};\n  return ENGINE.runKernel('Square', {x: $x, attrs});\n}\n\nexport const square = op({square_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {parseAxisParam} from './util';\n\nimport {expandShapeToKeepDim} from './axis_util';\nimport {cast} from './cast';\nimport {mean} from './mean';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {square} from './square';\nimport {sub} from './sub';\n\n/**\n * Calculates the mean and variance of `x`. The mean and variance are\n * calculated by aggregating the contents of `x` across `axes`.\n * If `x` is 1-D and `axes = [0]` this is just the mean and variance of a vector.\n * @param x The input tensor.\n * @param axis The dimension(s) along with to compute mean and variance. By default it reduces all dimensions.\n * @param keepDims If true, the moments have the same dimensionality as the input.\n * @return An object with two keys: `mean` and `variance`.\n * @doc {heading: 'Operations', subheading:
```

```
'Normalization')\n *\nfunction moments_(\n  x: Tensor|TensorLike, axis: number|number[] = null,\n  keepDims = false): {mean: Tensor, variance: Tensor} {\n  x = convertToTensor(x, 'x', 'moments');\n  const axes =\n  parseAxisParam(axis, x.shape);\n  const xMean = mean(x, axes, keepDims);\n  let keepDimsShape =\n  xMean.shape;\n  if (!keepDims) {\n    keepDimsShape = expandShapeToKeepDim(xMean.shape, axes);\n  }\n  const devSquared =\n  square(sub(cast(x, 'float32'), reshape(xMean, keepDimsShape)));\n  const variance =\n  mean(devSquared, axes, keepDims);\n  return {mean: xMean, variance};\n}\n\nexport const moments =\n  op({moments_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\nimport {Tensor2D} from './tensor';\nimport {convertToTensor, convertToTensorArray} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * @docalias\n (data: Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D]\n *\nexport type LSTMCellFunc = {\n (data:\n Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D];\n};\n\n/**\n * Computes the next states and outputs\n of a stack of LSTMCells.\n *\n * Each cell output is used as input to the next cell.\n *\n * Returns `[cellState,\n cellOutput]`.\n *\n * Derived from tf.contrib.rnn.MultiRNNCell.\n *\n * @param lstmCells Array of LSTMCell\n functions.\n * @param data The input to the cell.\n * @param c Array of previous cell states.\n * @param h Array\n of previous cell outputs.\n *\n * @doc {heading: 'Operations', subheading: 'RNN'}\n *\nfunction multiRNNCell_(\n  lstmCells: LSTMCellFunc[], data: Tensor2D|TensorLike,\n  c: Array<Tensor2D|TensorLike>,\n  h:\n Array<Tensor2D|TensorLike>): [Tensor2D[], Tensor2D[]] {\n  const $data = convertToTensor(data, 'data',\n 'multiRNNCell');\n  const $c = convertToTensorArray(c, 'c', 'multiRNNCell');\n  const $h =\n  convertToTensorArray(h, 'h', 'multiRNNCell');\n  let input = $data;\n  const newStates = [];\n  for (let i = 0; i <\n lstmCells.length; i++) {\n    const output = lstmCells[i](input, $c[i], $h[i]);\n    newStates.push(output[0]);\n    newStates.push(output[1]);\n    input = output[1];\n  }\n  const newC: Tensor2D[] = [];\n  const newH: Tensor2D[] =\n  [];\n  for (let i = 0; i < newStates.length; i += 2) {\n    newC.push(newStates[i]);\n    newH.push(newStates[i + 1]);\n  }\n  return [newC, newH];\n}\n\nexport const multiRNNCell = op({multiRNNCell_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\nimport {ENGINE} from './engine';\nimport {Multinomial, MultinomialAttrs, MultinomialInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D, Tensor2D} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\nimport {reshape} from\n './reshape';\n\n/**\n * Creates a `tf.Tensor` with values drawn from a multinomial distribution.\n *\n * ``js\n * const\n probs = tf.tensor([.75, .25]);\n * tf.multinomial(probs, 3).print();\n * ``\n *\n * @param logits 1D array with\n unnormalized log-probabilities, or\n * 2D array of shape `[batchSize, numOutcomes]`. See the `normalized`\n * parameter.\n * @param numSamples Number of samples to draw for each row slice.\n * @param seed The seed\n number.\n * @param normalized Whether the provided `logits` are normalized true\n * probabilities (sum to 1).\n Defaults to false.\n * @return 1D array of shape `[numSamples]`, or 2D array of shape\n * `[batchSize,\n numSamples]`, depending on the rank of the input.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n
```

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*\nfunction multinomial_(\n  logits: Tensor1D|Tensor2D|TensorLike, numSamples: number, seed?: number,\n  normalized = false): Tensor1D|Tensor2D {\n  const $logits = convertToTensor(logits, 'logits', 'multinomial');\n  const numOutcomes = $logits.size;\n  const origRank = $logits.rank;\n  if (numOutcomes < 2) {\n    throw new\n    Error(\n      `Error in multinomial: you need at least 2 outcomes, but got ` +\n      `${numOutcomes}.`);\n  }\n  if\n  (origRank > 2) {\n    throw new Error(`Rank of probabilities must be 1 or 2, but is ${origRank}`);\n  }\n  //\n  TODO(lina128): Investigate correct seed behavior. The code seems not allow\n  // setting see to 0.\n  seed = seed ||\n  Math.random();\n  // The kernel only accepts (and returns) rank 2 tensors.\n  const logits2D: Tensor2D =\n  origRank === 1 ? reshape($logits, [1, -1]) : $logits as Tensor2D;\n  \n  const inputs: MultinomialInputs = {logits:\n  logits2D};\n  const attrs: MultinomialAttrs = {numSamples, seed, normalized};\n  // tslint:disable-next-line: no-\n  unnecessary-type-assertion\n  const res = ENGINE.runKernel(\n    Multinomial, inputs as {} as\n  NamedTensorMap,\n    attrs as {} as NamedAttrMap) as Tensor2D;\n  // tslint:disable-next-line:no-\n  unnecessary-type-assertion\n  return origRank === 1 ? reshape(res, [res.size]) as Tensor1D : res;\n}\n\n\nexport const\n  multinomial = op({multinomial_});\n\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n  compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *  

=====\n\n*\nimport {ENGINE} from './engine';\nimport {NotEqual, NotEqualInputs} from './kernel_names';\nimport\n  {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from\n  './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport\n  {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth\n  value of (a != b) element-wise. Supports broadcasting.\n * \n * ```\n * const a = tf.tensor1d([1, 2, 3]);\n * const b =\n  tf.tensor1d([0, 2, 3]);\n * \n * a.notEqual(b).print();\n * ```\n * @param a The first input tensor.\n * @param b The\n  second input tensor. Must have the same dtype as `a`.\n * @doc {heading: 'Operations', subheading: 'Logical'}\n\n*\nfunction notEqual<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a =\n  convertToTensor(a, 'a', 'notEqual');\n  let $b = convertToTensor(b, 'b', 'notEqual');\n  [$a, $b] =\n  makeTypesMatch($a, $b);\n  \n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  \n  const inputs: NotEqualInputs\n  = {a: $a, b: $b};\n  \n  return ENGINE.runKernel(NotEqual, inputs as {} as NamedTensorMap);\n}\n\n\nexport const\n  notEqual = op({notEqual_});\n\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n  compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *  

=====\n\n*\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap}\n  from './types';\nimport {makeZerosTypedArray, sizeFromShape} from './util';\nimport {complex} from\n  './complex';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 0.\n * \n * ```\n * tf.zeros([2, 2]).print();\n * ```\n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The type of an\n  element in the resulting tensor. Can\n * be 'float32', 'int32' or 'bool'. Defaults to 'float'.  

*\n * @doc {heading:\n  'Tensors', subheading: 'Creation'}\n\n*\nexport function zeros<R extends Rank>(\n  shape: ShapeMap[R], dtype:\n  DataType = 'float32'): Tensor<R> {\n  if (dtype === 'complex64') {\n    const real = zeros(shape, 'float32');\n    const\n    imag = zeros(shape, 'float32');\n    return complex(real, imag);\n  }\n  \n  const values =\n  makeZerosTypedArray(sizeFromShape(shape), dtype);\n  \n  return ENGINE.makeTensor(values, shape, dtype) as

```

Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {makeOnesTypedArray, sizeFromShape} from './util';\nimport {complex} from './complex';\nimport {zeros} from './zeros';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 1.\n *```\n * tf.ones([2, 2]).print();\n *```\n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The type of an element in the resulting tensor. Defaults to\n *   'float'.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nexport function ones<R extends Rank>(\n  shape: ShapeMap[R], dtype: DataType = 'float32'):\n  Tensor<R> {\n  if (dtype === 'complex64') {\n    const real = ones(shape, 'float32');\n    const imag = zeros(shape, 'float32');\n    return complex(real, imag);\n  }\n  const values =\n    makeOnesTypedArray(sizeFromShape(shape), dtype);\n  return ENGINE.makeTensor(values, shape, dtype) as\n  Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {OnesLike, OnesLikeInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 1 with the same shape as the\n * given tensor.\n *```\n * const x =\n *   tf.tensor([1, 2]);\n *   tf.onesLike(x).print();\n *```\n * @param x A tensor.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction onesLike_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =\n    convertToTensor(x, 'x', 'onesLike');\n  const inputs: OnesLikeInputs = {x: $x};\n  return\n    ENGINE.runKernel(OnesLike, inputs as { } as NamedTensorMap);\n}\n\nexport const onesLike =\n  op({onesLike_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {matMul} from './mat_mul';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the outer product of two vectors, `v1` and `v2`.\n *```\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([3, 4, 5]);\n *\n * tf.outerProduct(a, b).print();\n *```\n * @param v1 The first vector in the outer product operation.\n * @param v2 The second vector in the outer product operation.\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n */\nfunction outerProduct_(\n  v1: Tensor1D|TensorLike, v2: Tensor1D|TensorLike): Tensor2D {\n  const $v1 =
```

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convertToTensor(v1, 'v1', 'outerProduct');\n const $v2 = convertToTensor(v2, 'v2', 'outerProduct');\n\n util.assert(\n
  $v1.rank === 1 && $v2.rank === 1,\n    () => `Error in outerProduct: inputs must be rank 1, but got ranks ` +\n
  `${$v1.rank} and `${$v2.rank}`);\n\n const v12D = reshape($v1, [-1, 1]);\n const v22D = reshape($v2, [1, -\n
  1]);\n return matMul(v12D, v22D);\n}\n\nexport const outerProduct = op({ outerProduct_});\n", "/*\n * @license\n
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  \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n
  License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n
  agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n
  the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {ENGINE} from './engine';\nimport {PadV2, PadV2Attrs, PadV2Inputs} from\n
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport\n
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport\n
 {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Pads a `tf.Tensor` with a given value and\n
  paddings.\n * This operation implements `CONSTANT` mode. For `REFLECT` and `SYMMETRIC`,\n * refer\n
  to `tf.mirrorPad`.\n * Also available are stricter rank-specific methods with the same signature\n * as this method\n
  that assert that `paddings` is of given length.\n * - `tf.pad1d`\n * - `tf.pad2d`\n * - `tf.pad3d`\n * - `tf.pad4d`\n
  *\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * x.pad([[1, 2]]).print();\n * ```\n * @param x The tensor to pad.\n
  * @param paddings An array of length `R` (the rank of the tensor), where\n * each element is a length-2 tuple of\n
  ints `[padBefore, padAfter]`,\n * specifying how much to pad along each dimension of the tensor.\n * @param\n
  constantValue The pad value to use. Defaults to 0.\n * @doc {heading: 'Tensors', subheading:\n
  'Transformations'}\n *\nfunction pad<T extends Tensor>(\n  x: T|TensorLike, paddings: Array<[number,\n
  number]>, constantValue = 0): T {\n  const $x = convertToTensor(x, 'x', 'pad');\n  if ($x.rank === 0) {\n    throw\n
    new Error('pad(scalar) is not defined. Pass non-scalar to pad');\n  }\n  const attrs: PadV2Attrs = {paddings,\n
  constantValue};\n  const inputs: PadV2Inputs = {x: $x};\n  return ENGINE.runKernel(\n    PadV2, inputs as\n
  unknown as NamedTensorMap,\n    attrs as unknown as NamedAttrMap);\n}\n\nexport const pad =\n
op({pad_});\n", "/*\n * @license\n
 * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n
  Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n
  License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n
  required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n
  on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n
  implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n
  License.\n *

```

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=====\n
*\n\nimport {Tensor1D} from './tensor';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport\n
 {op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor1D` with a given value and\n
  paddings. See `pad` for details.\n *\nfunction pad1d_(\n  x: Tensor1D|TensorLike, paddings: [number, number],\n
  constantValue = 0): Tensor1D {\n  assert(\n    paddings.length === 2,\n    () => 'Invalid number of paddings.\n
  Must be length of 2.);\n  return pad(x, [paddings], constantValue);\n}\n\nexport const pad1d =\n
op({pad1d_});\n", "/*\n * @license\n
 * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n
  Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n
  License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n
  required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n
  on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n
  implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n
  License.\n *

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```

*\nimport {Tensor2D} from './tensor';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor2D` with a given value and
paddings. See `pad` for details.\n *\nfunction pad2d_(\n  x: Tensor2D|TensorLike, paddings: [[number, number],
[number, number]],\n  constantValue = 0): Tensor2D {\n  assert(\n    paddings.length === 2 &&\n    paddings[0].length === 2 &&\n    paddings[1].length === 2,\n    () => 'Invalid number of paddings. Must be
length of 2 each.);\n  return pad(x, paddings, constantValue);\n}\n\nexport const pad2d = op({pad2d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor3D} from './tensor';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor3D` with a given value and
paddings. See `pad` for details.\n *\nfunction pad3d_(\n  x: Tensor3D|TensorLike,\n  paddings: [[number,
number], [number, number], [number, number]],\n  constantValue = 0): Tensor3D {\n  assert(\n    paddings.length
=== 3 && paddings[0].length === 2 &&\n    paddings[1].length === 2 && paddings[2].length === 2,\n    ()
=> 'Invalid number of paddings. Must be length of 2 each.);\n  return pad(x, paddings, constantValue);\n}\n\nexport
const pad3d = op({pad3d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {Tensor4D} from './tensor';\nimport {TensorLike} from './types';\nimport {assert} from './util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor4D` with a given value and
paddings. See `pad` for details.\n *\nfunction pad4d_(\n  x: Tensor4D|TensorLike,\n  paddings:\n    [\n    [number, number], [number, number], [number, number], [number, number]\n    ],\n  constantValue = 0):
Tensor4D {\n  assert(\n    paddings.length === 4 && paddings[0].length === 2 &&\n    paddings[1].length ===
2 && paddings[2].length === 2 &&\n    paddings[3].length === 2,\n    () => 'Invalid number of paddings. Must
be length of 2 each.);\n  return pad(x, paddings, constantValue);\n}\n\nexport const pad4d =
op({pad4d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\nimport {ENGINE} from './engine';\nimport {SpaceToBatchND, SpaceToBatchNDAttrs,
SpaceToBatchNDInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from
 './operation';\n\n/**\n * This operation divides "spatial" dimensions `[1, ..., M]` of the input into\n * a grid of
blocks of shape `blockShape`, and interleaves these blocks with\n * the "batch" dimension (0) such that in the

```

output, the spatial dimensions `[1, ..., M]` correspond to the position within the grid, and the batch dimension combines both the position within a spatial block and the original batch position. Prior to division into blocks, the spatial dimensions of the input are optionally zero padded according to `padding`. See below for a precise description.

```

const x = tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]);
const blockSize = [2, 2];
const padding = [[0, 0], [0, 0]];
x.spaceToBatchND(blockSize, padding).print();

```

`x` is a `tf.Tensor`. N-D with `x.shape = [batch] + spatialShape + remainingShape`, where `spatialShape` has `M` dimensions. `blockSize` is a 1-D array. Must have shape `[M]`, all values must be `>= 1`. `padding` is a 2-D array. Must have shape `[M, 2]`, all values must be `>= 0`. `padding[i] = [padStart, padEnd]` specifies the amount to zero-pad from input dimension `i + 1`, which corresponds to spatial dimension `i`. It is required that `(inputShape[i + 1] + padStart + padEnd) % blockSize[i] === 0`. This operation is equivalent to the following steps:

- Zero-pad the start and end of dimensions `[1, ..., M]` of the input according to `padding` to produce `padded` of shape `paddedShape`.
- Reshape `padded` to `reshapedPadded` of shape: `[batch] + [paddedShape[1] / blockSize[0], blockSize[0], ..., paddedShape[M] / blockSize[M-1], blockSize[M-1]] + remainingShape`.
- Permute dimensions of `reshapedPadded` to produce `permutedReshapedPadded` of shape: `blockSize + [batch] + [paddedShape[1] / blockSize[0], ..., paddedShape[M] / blockSize[M-1]] + remainingShape`.
- Reshape `permutedReshapedPadded` to flatten `blockSize` into the batch dimension, producing an output tensor of shape: `[batch * prod(blockSize)] + [paddedShape[1] / blockSize[0], ..., paddedShape[M] / blockSize[M-1]] + remainingShape`.

`TensorLike` `spaceToBatchND` extends `Tensor`

```

class TensorLike {
  constructor(x: T, blockSize: number[], padding: number[][]): T {
    const $x = convertToTensor(x, 'x', 'spaceToBatchND');
    util.assert($x.rank >= 1 + blockSize.length, () => `input rank ${$x.rank} should be > than [blockSize]`);
    util.assert(padding.length === blockSize.length, () => `padding.shape[0] ${padding.length} must be equal to [blockSize]`);
    util.assert($x.shape.reduce((a, b, i) => {
      if (i > 0 && i <= blockSize.length) {
        return a && ((b + padding[i - 1][0] + padding[i - 1][1]) % blockSize[i - 1] === 0);
      }
      return a;
    }, true), () => `input spatial dimensions ${$x.shape.slice(1)} with padding ${padding.toString()} must be divisible by blockShapes [blockSize]`);
    const inputs: SpaceToBatchNDInputs = {x: $x};
    const attrs: SpaceToBatchNDAttrs = {blockSize, padding};
    return ENGINE.runKernel(spaceToBatchND, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
  }
}
export const spaceToBatchND = op({spaceToBatchND_});

```

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```

import {Tensor3D, Tensor4D} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike} from './types';
import * as util from './util';
import {avgPool} from './avg_pool';
import {batchToSpaceND} from './batch_to_space_nd';
import * as conv_util from './conv_util';
import {maxPool} from './max_pool';
import {op} from './operation';
import {reshape} from './reshape';
import {spaceToBatchND} from './space_to_batch_nd';

```

`spaceToBatchND` Performs an N-D pooling operation

`input` The input tensor, of rank 4 or rank 3 of shape `[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.

`blockSize` The filter size: `[filterHeight, filterWidth]`. If `blockSize` is a single number, then `filterHeight == filterWidth`.

`paddingType` The type of pooling, either 'max' or 'avg'.

`padding` The type of padding algorithm: `'same'` and stride 1: output will be of same size as input, regardless of filter size. `'valid'`: output will be smaller than input if filter is larger than 1x1.

For more info, see this


```

guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates:
`[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n *
in dilated pooling. Defaults to `[1, 1]`. If `dilationRate` is a single\n * number, then `dilationHeight ==
dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param strides The strides of
the pooling: `[strideHeight, strideWidth]`. If\n * `strides` is a single number, then `strideHeight == strideWidth`.\n
*\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction pool_<T extends
Tensor3D|Tensor4D>(\n input: T|TensorLike, windowShape: [number, number]|number,\n poolingType:
'avg'|'max', pad: 'valid'|'same'|number,\n dilations?: [number, number]|number, strides?: [number, number]|number)
{\n if (dilations == null) {\n dilations = [1, 1];\n }\n if (strides == null) {\n strides = 1;\n }\n if (pad === 0)
{\n pad = 'valid';\n }\n\n const $x = convertToTensor(input, 'x', 'maxPool');\n let x4D = $x as Tensor4D;\n let
reshapedTo4D = false;\n\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x, [1, $x.shape[0],
$x.shape[1], $x.shape[2]]);\n }\n\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n
() => 'Error in pool: Either strides or dilations must be 1. ' +\n `Got strides ${strides} and dilations
`${dilations}``);\n\n const convInfo = conv_util.computePool2DInfo(\n x4D.shape, windowShape, strides,
dilations, pad);\n const dilation: [number, number] = [\n [convInfo.dilationHeight, convInfo.dilationWidth];\n\n //
The following implementation does batchToSpace(pool(spaceToBatch(x)))\n // whenever dilation > 1 since the TF
kernels do not support dilation > 1.\n // tslint:disable-next-line:max-line-length\n //
https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/op
s/nn_ops.py#L1037\n\n let basePadding: number[][];\n if (pad === 'same') {\n basePadding =
withSpaceToBatchBasePaddings(\n [convInfo.filterHeight, convInfo.filterWidth], dilation);\n } else {\n
basePadding = [[0, 0], [0, 0]];\n }\n\n const isDilationOne = dilation[0] === 1 && dilation[1] === 1;\n const
[adjustedPadding, adjustedCrops] = requiredSpaceToBatchPaddings(\n [convInfo.inHeight, convInfo.inWidth],
dilation, basePadding);\n const convertedPad = isDilationOne ? pad : 'valid';\n const convertedX =\n
isDilationOne ? x4D : spaceToBatchND(x4D, dilation, adjustedPadding);\n\n const forwardOp = poolingType ===
'avg' ?\n () => avgPool(convertedX, windowShape, strides, convertedPad) :\n () => maxPool(convertedX,
windowShape, strides, convertedPad);\n const y = forwardOp();\n\n const res = isDilationOne ? y :
batchToSpaceND(y, dilation, adjustedCrops);\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1],
res.shape[2], res.shape[3]]) as T;\n }\n\n return res as T;\n}\n\n// Helper function to compute crops and paddings
for pool with dilation > 1.\n// tslint:disable-next-line:max-line-length\n//
https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/op
s/array_ops.py#L2184\nfunction requiredSpaceToBatchPaddings(\n inputShape: [number, number], blockShape:
[number, number],\n basePadding: number[][]) {\n const padStart = basePadding.map(b => b[0]);\n const
origPadEnd = basePadding.map(b => b[1]);\n const fullInputShape = inputShape.concat(padStart, origPadEnd);\n
const padEndExtra = blockShape.map((b, i) => (b - fullInputShape[i] % b) % b);\n const padEnd =
origPadEnd.map((s, i) => s + padEndExtra[i]);\n const paddings = blockShape.map(_ , i) => [padStart[i],
padEnd[i]]);\n const crops = blockShape.map(_ , i) => [0, padEndExtra[i]]);\n return [paddings, crops];\n}\n\n//
Helper function to compute base paddings for pool with dilation > 1.\n// tslint:disable-next-line:max-line-length\n//
https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/op
s/nn_ops.py#L524\nfunction withSpaceToBatchBasePaddings(\n filterShape: [number, number], dilation:
[number, number]) {\n // Spatial dimensions of the filters and the upsampled filters in which we\n // introduce (rate
- 1) zeros between consecutive filter values.\n const dilatedFilterShape = filterShape.map((s, i) => {\n return s +
(s - 1) * (dilation[i] - 1);\n });\n const padExtraShape = dilatedFilterShape.map(s => s - 1);\n\n // When padding is
odd, we pad more at end, following the same\n // convention as conv2d.\n const padExtraStart =
padExtraShape.map(s => Math.floor(s / 2));\n const padExtraEnd = padExtraShape.map((s, i) => s -
padExtraStart[i]);\n return padExtraShape.map(_ , i) => {\n return [padExtraStart[i], padExtraEnd[i]];\n
});\n}\n\n\nexport const pool = op({pool_});\n"}/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file

```

except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * <http://www.apache.org/licenses/LICENSE-2.0>\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Pow, PowInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes the power of one `tf.Tensor` to another. Supports broadcasting.\n *\n * Given a `tf.Tensor` x and a `tf.Tensor` y, this operation computes x^y for\n * corresponding elements in x and y. The result's dtype will be the upcasted\n * type of the `base` and `exp` dtypes.\n *\n * ```js\n * const a = tf.tensor([[2, 3], [4, 5]])\n * const b = tf.tensor([[1, 2], [3, 0]])\n * a.pow(b).print(); // or tf.pow(a, b)\n * ```\n *\n * ```js\n * const a = tf.tensor([[1, 2], [3, 4]])\n * const b = tf.tensor(2)\n * a.pow(b).print(); // or tf.pow(a, b)\n * ```\n * We also expose `powStrict` which has the same signature as this op and\n * asserts that `base` and `exp` are the same shape (does not broadcast).\n *\n * @param base The base `tf.Tensor` to pow element-wise.\n * @param exp The exponent `tf.Tensor` to pow element-wise.\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction pow<T extends Tensor>(base: Tensor|TensorLike, exp: Tensor|TensorLike): T {\n  let $base = convertToTensor(base, 'base', 'pow');\n  let $exp = convertToTensor(exp, 'exp', 'pow');\n  [$base, $exp] = makeTypesMatch($base, $exp);\n\n  const inputs: PowInputs = {a: $base, b: $exp};\n\n  return ENGINE.runKernel(Pow, inputs as { } as NamedTensorMap);\n}\n\nexport const pow = op({pow_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Prelu, PreluInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes leaky rectified linear element-wise with parametric alphas.\n *\n *  $x < 0 ? \\alpha * x : f(x) = x$ \n *\n * ```js\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n * const alpha = tf.scalar(0.1);\n * x.prelu(alpha).print(); // or tf.prelu(x, alpha)\n * ```\n *\n * @param x The input tensor.\n * @param alpha Scaling factor for negative values.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction prelu<T extends Tensor>(x: T|TensorLike, alpha: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'prelu');\n  const $alpha = convertToTensor(alpha, 'alpha', 'prelu');\n\n  const inputs: PreluInputs = {x: $x, alpha: $alpha};\n  return ENGINE.runKernel(Prelu, inputs as { } as NamedTensorMap);\n}\n\nexport const prelu = op({prelu_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ENGINE} from './engine';\nimport {Prod, ProdAttrs, ProdInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
```



```

THE USE OR OTHER DEALINGS IN THE SOFTWARE.
(function(global, module, define)
{
function Alea(seed) {
  var me = this, mash = Mash();
  me.next = function() {
    var t = 2091639 * me.s0
    + me.c * 2.3283064365386963e-10; // 2^-32
    me.s0 = me.s1;
    me.s1 = me.s2;
    return me.s2 = t - (me.c = t |
0);
  };
  // Apply the seeding algorithm from Baagoe.
  me.c = 1;
  me.s0 = mash(' ');
  me.s1 = mash(' ');
  me.s2 = mash(' ');
  me.s0 -= mash(seed);
  if (me.s0 < 0) { me.s0 += 1; }
  me.s1 -= mash(seed);
  if (me.s1 < 0)
{ me.s1 += 1; }
  me.s2 -= mash(seed);
  if (me.s2 < 0) { me.s2 += 1; }
  mash = null;
}
function copy(f, t)
{
  t.c = f.c;
  t.s0 = f.s0;
  t.s1 = f.s1;
  t.s2 = f.s2;
  return t;
}
function impl(seed, opts) {
  var xg = new
  Alea(seed),
  state = opts && opts.state,
  prng = xg.next;
  prng.int32 = function() { return (xg.next() *
0x100000000) | 0; }
  prng.double = function() {
    return prng() + (prng() * 0x200000 | 0) *
1.1102230246251565e-16; // 2^-53
  };
  prng.quick = prng;
  if (state) {
    if (typeof(state) === 'object')
copy(state, xg);
    prng.state = function() { return copy(xg, {}); }
  }
  return prng;
}
function Mash() {
  var n = 0xefc8249d;
  var mash = function(data) {
    data = data.toString();
    for (var i = 0; i < data.length;
i++) {
      n += data.charCodeAt(i);
      var h = 0.02519603282416938 * n;
      n = h >>> 0;
      h -= n;
      h *= n;
      n = h >>> 0;
      h -= n;
      n += h * 0x100000000; // 2^32
    }
    return (n >>> 0) *
2.3283064365386963e-10; // 2^-32
  };
  return mash;
}
if (module && module.exports) {
  module.exports = impl;
} else if (define && define.amd) {
  define(function() { return impl; });
} else {
  this.alea = impl;
}
})(this, (typeof module) === 'object' && module, // present in node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript implementaion of the
"xor128" prng algorithm by
George Marsaglia. See http://www.jstatsoft.org/v08/i14/paper
(function(global, module, define) {
function XorGen(seed) {
  var me = this, strseed = "";
  me.x = 0;
  me.y = 0;
  me.z = 0;
  me.w = 0;
  // Set up generator function.
  me.next = function() {
    var t = me.x ^ (me.x << 11);
    me.x = me.y;
    me.y = me.z;
    me.z = me.w;
    return me.w ^= (me.w >>> 19) ^ t ^ (t >>> 8);
  };
  if (seed ===
(seed | 0)) {
    // Integer seed.
    me.x = seed;
  } else {
    // String seed.
    strseed += seed;
  }
  // Mix in
string seed, then discard an initial batch of 64 values.
  for (var k = 0; k < strseed.length + 64; k++) {
    me.x ^=
strseed.charCodeAt(k) | 0;
    me.next();
  }
}
function copy(f, t) {
  t.x = f.x;
  t.y = f.y;
  t.z = f.z;
  t.w =
f.w;
  return t;
}
function impl(seed, opts) {
  var xg = new XorGen(seed),
  state = opts && opts.state,
  prng = function() { return (xg.next() >>> 0) / 0x100000000; };
  prng.double = function() {
    do {
      var top =
xg.next() >>> 11,
      bot = (xg.next() >>> 0) / 0x100000000,
      result = (top + bot) / (1 << 21);
    } while
(result === 0);
    return result;
  };
  prng.int32 = xg.next;
  prng.quick = prng;
  if (state) {
    if (typeof(state)
=== 'object') copy(state, xg);
    prng.state = function() { return copy(xg, {}); }
  }
  return prng;
}
if (module
&& module.exports) {
  module.exports = impl;
} else if (define && define.amd) {
  define(function() { return
impl; });
} else {
  this.xor128 = impl;
}
}
})(this, (typeof module) === 'object' && module, // present in
node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript
implementaion of the "xorwow" prng algorithm by
George Marsaglia. See
http://www.jstatsoft.org/v08/i14/paper
(function(global, module, define) {
function XorGen(seed) {
  var me =
this, strseed = "";
  // Set up generator function.
  me.next = function() {
    var t = (me.x ^ (me.x >>> 2));
    me.x = me.y;
    me.y = me.z;
    me.z = me.w;
    me.w = me.v;
    return (me.d = (me.d + 362437 | 0)) + (me.v =
(me.v ^ (me.v << 4)) ^ (t ^ (t << 1))) | 0);
  };
  me.x = 0;
  me.y = 0;
  me.z = 0;
  me.w = 0;
  me.v = 0;
  if (seed ===
(seed | 0)) {
    // Integer seed.
    me.x = seed;
  } else {
    // String seed.
    strseed += seed;
  }
  // Mix in
string seed, then discard an initial batch of 64 values.
  for (var k = 0; k < strseed.length + 64; k++) {
    me.x ^=
strseed.charCodeAt(k) | 0;
    if (k === strseed.length) {
      me.d = me.x << 10 ^ me.x >>> 4;
    }
    me.next();
  }
}
function copy(f, t) {
  t.x = f.x;
  t.y = f.y;
  t.z = f.z;
  t.w = f.w;
  t.v = f.v;
  t.d =
f.d;
  return t;
}
function impl(seed, opts) {
  var xg = new XorGen(seed),
  state = opts && opts.state,
  prng = function() { return (xg.next() >>> 0) / 0x100000000; };
  prng.double = function() {
    do {
      var top =
xg.next() >>> 11,
      bot = (xg.next() >>> 0) / 0x100000000,
      result = (top + bot) / (1 << 21);
    } while
(result === 0);
    return result;
  };
  prng.int32 = xg.next;
  prng.quick = prng;
  if (state) {
    if (typeof(state)
=== 'object') copy(state, xg);
    prng.state = function() { return copy(xg, {}); }
  }
  return prng;
}
if (module
&& module.exports) {
  module.exports = impl;
} else if (define && define.amd) {
  define(function() { return
impl; });
} else {
  this.xorwow = impl;
}
}
})(this, (typeof module) === 'object' && module, // present in
node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript

```

```

impl; });\n} else {\n this.xorwow = impl;\n}\n})(\n this,\n (typeof module) === 'object' && module, // present
in node.js\n (typeof define) === 'function' && define // present with an AMD loader\n);\n\n", "// A Javascript
implementaion of the \"xorshift7\" algorithm by\n// François Panneton and Pierre L'ecuyer:\n\n\"On the Xorshift
Random Number Generators\""\n//
http://saluc.engr.uconn.edu/refs/crypto/rng/panneton05onthexorshift.pdf\n\n(function(global, module, define)
{\n\nfunction XorGen(seed) {\n var me = this;\n\n // Set up generator function.\n me.next = function() {\n //
Update xor generator.\n var X = me.x, i = me.i, t, v, w;\n t = X[i]; t ^= (t >>> 7); v = t ^ (t <<< 24);\n t = X[(i +
1) & 7]; v ^= t ^ (t >>> 10);\n t = X[(i + 3) & 7]; v ^= t ^ (t >>> 3);\n t = X[(i + 4) & 7]; v ^= t ^ (t <<< 7);\n t =
X[(i + 7) & 7]; t = t ^ (t <<< 13); v ^= t ^ (t <<< 9);\n X[i] = v;\n me.i = (i + 1) & 7;\n return v;\n };\n\n function
init(me, seed) {\n var j, w, X = [];\n\n if (seed === (seed | 0)) {\n // Seed state array using a 32-bit integer.\n
w = X[0] = seed;\n } else {\n // Seed state using a string.\n seed = \" + seed;\n for (j = 0; j < seed.length;
++j) {\n X[j & 7] = (X[j & 7] <<< 15) ^\n (seed.charCodeAt(j) + X[(j + 1) & 7] <<< 13);\n }\n }\n //
Enforce an array length of 8, not all zeroes.\n while (X.length < 8) X.push(0);\n for (j = 0; j < 8 && X[j] === 0;
++j);\n if (j == 8) w = X[7] = -1; else w = X[j];\n\n me.x = X;\n me.i = 0;\n\n // Discard an initial 256
values.\n for (j = 256; j > 0; --j) {\n me.next();\n }\n }\n\n init(me, seed);\n}\n\nfunction copy(f, t) {\n t.x =
f.x.slice();\n t.i = f.i;\n return t;\n}\n\nfunction impl(seed, opts) {\n if (seed == null) seed = +(new Date);\n var xg
= new XorGen(seed),\n state = opts && opts.state,\n prng = function() { return (xg.next() >>> 0) /
0x100000000; };\n prng.double = function() {\n do {\n var top = xg.next() >>> 11,\n bot = (xg.next()
>>> 0) / 0x100000000,\n result = (top + bot) / (1 <<< 21);\n } while (result === 0);\n return result;\n };\n
prng.int32 = xg.next;\n prng.quick = prng;\n if (state) {\n if (state.x) copy(state, xg);\n prng.state = function() {
return copy(xg, {}); }\n }\n return prng;\n}\n\nif (module && module.exports) {\n module.exports = impl;\n} else
if (define && define.amd) {\n define(function() { return impl; });\n} else {\n this.xorshift7 = impl;\n}\n})(\n
this,\n (typeof module) === 'object' && module, // present in node.js\n (typeof define) === 'function' && define //
present with an AMD loader\n);\n\n", "// A Javascript implementaion of Richard Brent's Xorgens xor4096
algorithm.\n\n// This fast non-cryptographic random number generator is designed for\n// use in Monte-Carlo
algorithms. It combines a long-period xorshift\n// generator with a Weyl generator, and it passes all common
batteries\n// of stastical tests for randomness while consuming only a few nanoseconds\n// for each prng generated.
For background on the generator, see Brent's\n// paper: \"Some long-period random number generators using shifts
and xors.\""\n// http://arxiv.org/pdf/1004.3115v1.pdf\n\n// Usage:\n\n// var xor4096 = require('xor4096');\n\n//
random = xor4096(1); // Seed with int32 or string.\n// assert.equal(random(), 0.1520436450538547);\n// (0, 1) range,
53 bits.\n// assert.equal(random.int32(), 1806534897); // signed int32, 32 bits.\n\n// For nonzero
numeric keys, this impelementation provides a sequence\n// identical to that by Brent's xorgens 3 implementaion in
C. This\n// implementation also provides for initalizing the generator with\n// string seeds, or for saving and
restoring the state of the generator.\n\n// On Chrome, this prng benchmarks about 2.1 times slower than\n//
Javascript's built-in Math.random().\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n var me =
this;\n\n // Set up generator function.\n me.next = function() {\n var w = me.w,\n X = me.X, i = me.i, t, v;\n\n //
Update Weyl generator.\n me.w = w = (w + 0x61c88647) | 0;\n // Update xor generator.\n v = X[(i + 34) &
127];\n t = X[i = ((i + 1) & 127)];\n v ^= v <<< 13;\n t ^= t <<< 17;\n v ^= v >>> 15;\n t ^= t >>> 12;\n //
Update Xor generator array state.\n v = X[i] = v ^ t;\n me.i = i;\n // Result is the combination.\n return (v +
(w ^ (w >>> 16))) | 0;\n };\n\n function init(me, seed) {\n var t, v, i, j, w, X = [], limit = 128;\n if (seed ===
(seed | 0)) {\n // Numeric seeds initialize v, which is used to generates X.\n v = seed;\n seed = null;\n }
else {\n // String seeds are mixed into v and X one character at a time.\n seed = seed + '\\0';\n v = 0;\n
limit = Math.max(limit, seed.length);\n }\n // Initialize circular array and weyl value.\n for (i = 0, j = -32; j <
limit; ++j) {\n // Put the unicode characters into the array, and shuffle them.\n if (seed) v ^=
seed.charCodeAt((j + 32) % seed.length);\n // After 32 shuffles, take v as the starting w value.\n if (j === 0) w =
v;\n v ^= v <<< 10;\n v ^= v >>> 15;\n v ^= v <<< 4;\n v ^= v >>> 13;\n if (j >= 0) {\n w = (w +
0x61c88647) | 0; // Weyl.\n t = (X[j & 127] ^= (v + w)); // Combine xor and weyl to init array.\n i = (0
== t) ? i + 1 : 0; // Count zeroes.\n }\n }\n // We have detected all zeroes; make the key nonzero.\n if (i

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>= 128) {\n    X[(seed && seed.length || 0) & 127] = -1;\n    }\n    // Run the generator 512 times to further mix the
state before using it.\n    // Factoring this as a function slows the main generator, so it is just\n    // unrolled here.
The weyl generator is not advanced while warming up.\n    i = 127;\n    for (j = 4 * 128; j > 0; --j) {\n        v = X[(i +
34) & 127];\n        t = X[i = ((i + 1) & 127)];\n        v ^= v << 13;\n        t ^= t << 17;\n        v ^= v >>> 15;\n        t ^= t
>>> 12;\n        X[i] = v ^ t;\n    }\n    // Storing state as object members is faster than using closure variables.\n
me.w = w;\n    me.X = X;\n    me.i = i;\n    }\n\n    init(me, seed);\n\n\n    function copy(f, t) {\n        t.i = f.i;\n        t.w = f.w;\n
t.X = f.X.slice();\n        return t;\n    };\n\n\n    function impl(seed, opts) {\n        if (seed == null) seed = +(new Date);\n        var xg =
new XorGen(seed),\n            state = opts && opts.state,\n            prng = function() { return (xg.next() >>> 0) /
0x100000000; };\n        prng.double = function() {\n            do {\n                var top = xg.next() >>> 11,\n                    bot = (xg.next()
>>> 0) / 0x100000000,\n                    result = (top + bot) / (1 << 21);\n            } while (result === 0);\n            return result;\n        };\n
prng.int32 = xg.next;\n        prng.quick = prng;\n        if (state) {\n            if (state.X) copy(state, xg);\n            prng.state = function() {
return copy(xg, {}); }\n        }\n        return prng;\n    }\n\n\n    if (module && module.exports) {\n        module.exports = impl;\n    } else
if (define && define.amd) {\n        define(function() { return impl; });\n    } else {\n        this.xor4096 = impl;\n    }\n\n\n    (function (this,
// window object or global\n    (typeof module) == 'object' && module, // present in node.js\n    (typeof define) == 'function' && define // present with an AMD loader\n    )\n    )\n    ,"/ A Javascript implementaion of the
\"Tyche-i\" prng algorithm by\n    // Samuel Neves and Filipe Araujo.\n    // See https://eden.dei.uc.pt/~sneves/pubs/2011-
snfa2.pdf\n    (function(global, module, define) {\n\n\n    function XorGen(seed) {\n        var me = this, strseed = \";\n\n        // Set
up generator function.\n        me.next = function() {\n            var b = me.b, c = me.c, d = me.d, a = me.a;\n            b = (b << 25) ^
(b >>> 7) ^ c;\n            c = (c - d) | 0;\n            d = (d << 24) ^ (d >>> 8) ^ a;\n            a = (a - b) | 0;\n            me.b = b = (b << 20) ^ (b
>>> 12) ^ c;\n            me.c = c = (c - d) | 0;\n            me.d = (d << 16) ^ (c >>> 16) ^ a;\n            return me.a = (a - b) | 0;\n        };\n\n
/* The following is non-inverted tyche, which has better internal\n        * bit diffusion, but which is about 25% slower
than tyche-i in JS.\n        me.next = function() {\n            var a = me.a, b = me.b, c = me.c, d = me.d;\n            a = (me.a + me.b | 0)
>>> 0;\n            d = me.d ^ a; d = d << 16 ^ d >>> 16;\n            c = me.c + d | 0;\n            b = me.b ^ c; b = b << 12 ^ d >>> 20;\n
me.a = a = a + b | 0;\n            d = d ^ a; me.d = d = d << 8 ^ d >>> 24;\n            me.c = c = c + d | 0;\n            b = b ^ c;\n            return
me.b = (b << 7 ^ b >>> 25);\n        }\n        *\n\n        me.a = 0;\n        me.b = 0;\n        me.c = 2654435769 | 0;\n        me.d =
1367130551;\n\n        if (seed === Math.floor(seed)) {\n            // Integer seed.\n            me.a = (seed / 0x100000000) | 0;\n            me.b
= seed | 0;\n        } else {\n            // String seed.\n            strseed += seed;\n        }\n\n        // Mix in string seed, then discard an initial
batch of 64 values.\n        for (var k = 0; k < strseed.length + 20; k++) {\n            me.b ^= strseed.charCodeAtAt(k) | 0;\n            me.next();\n        }\n    }\n\n\n    function copy(f, t) {\n        t.a = f.a;\n        t.b = f.b;\n        t.c = f.c;\n        t.d = f.d;\n        return t;\n    };\n\n\n    function
impl(seed, opts) {\n        var xg = new XorGen(seed),\n            state = opts && opts.state,\n            prng = function() { return
(xg.next() >>> 0) / 0x100000000; };\n        prng.double = function() {\n            do {\n                var top = xg.next() >>> 11,\n                    bot = (xg.next() >>> 0) / 0x100000000,\n                    result = (top + bot) / (1 << 21);\n            } while (result === 0);\n            return
result;\n        };\n        prng.int32 = xg.next;\n        prng.quick = prng;\n        if (state) {\n            if (typeof(state) == 'object') copy(state,
xg);\n            prng.state = function() { return copy(xg, {}); }\n        }\n        return prng;\n    }\n\n\n    if (module && module.exports)
{\n        module.exports = impl;\n    } else if (define && define.amd) {\n        define(function() { return impl; });\n    } else {\n        this.tychei = impl;\n    }\n\n\n    (function (this,\n    (typeof module) == 'object' && module, // present in node.js\n    (typeof define) == 'function' && define // present with an AMD loader\n    )\n    )\n    ,"/*\n    Copyright 2014 David
Bau.\n\n    Permission is hereby granted, free of charge, to any person obtaining\n    a copy of this software and
associated documentation files (the\n    \"Software\"), to deal in the Software without restriction, including\n    without
limitation the rights to use, copy, modify, merge, publish,\n    distribute, sublicense, and/or sell copies of the Software,
and to\n    permit persons to whom the Software is furnished to do so, subject to\n    the following conditions:\n\n    The
above copyright notice and this permission notice shall be\n    included in all copies or substantial portions of the
Software.\n\n    THE SOFTWARE IS PROVIDED \"AS IS\", WITHOUT WARRANTY OF ANY KIND,\n    EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF\n    MERCHANTABILITY,
FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.\n\n    IN NO EVENT SHALL THE
AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY\n    CLAIM, DAMAGES OR OTHER
LIABILITY, WHETHER IN AN ACTION OF CONTRACT,\n    TORT OR OTHERWISE, ARISING FROM, OUT
OF OR IN CONNECTION WITH THE\n    SOFTWARE OR THE USE OR OTHER DEALINGS IN THE

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SOFTWARE.\n\n*/\n\n(function (pool, math) {\n\n// The following constants are related to IEEE 754
limits.\n\nvar global = this,\n    width = 256,    // each RC4 output is 0 <= x < 256\n    chunks = 6,    // at least
six RC4 outputs for each double\n    digits = 52,    // there are 52 significant digits in a double\n    rngname =
'random', // rngname: name for Math.random and Math.seedrandom\n    startdenom = math.pow(width, chunks),\n    significance = math.pow(2, digits),\n    overflow = significance * 2,\n    mask = width - 1,\n    nodecrypto;    //
node.js crypto module, initialized at the bottom.\n\n\n// seedrandom()\n\n// This is the seedrandom function
described above.\n\n\nfunction seedrandom(seed, options, callback) {\n    var key = [];\n    options = (options == true) ?
{ entropy: true } : (options || {});\n    // Flatten the seed string or build one from local entropy if needed.\n    var
shortseed = mixkey(flatten(\n    options.entropy ? [seed, toString(pool)] :\n    (seed == null) ? autoseed() : seed, 3),
key);\n    // Use the seed to initialize an ARC4 generator.\n    var arc4 = new ARC4(key);\n    // This function returns
a random double in [0, 1) that contains\n    // randomness in every bit of the mantissa of the IEEE 754 value.\n    var
prng = function() {\n    var n = arc4.g(chunks),    // Start with a numerator n < 2 ^ 48\n        d = startdenom,\n        // and denominator d = 2 ^ 48.\n        x = 0;    // and no 'extra last byte'.\n    while (n <
significance) {\n        // Fill up all significant digits by\n        n = (n + x) * width;    // shifting numerator and\n
d *= width;    // denominator and generating a\n        x = arc4.g(1);    // new least-significant-
byte.\n    }\n    while (n >= overflow) {\n        // To avoid rounding up, before adding\n        n /= 2;    //
last byte, shift everything\n        d /= 2;    // right using integer math until\n        x >>>= 1;\n        // we have exactly the desired bits.\n    }\n    return (n + x) / d;\n
};\n\n    prng.int32 = function() { return arc4.g(4) | 0; }\n    prng.quick = function() { return arc4.g(4) / 0x100000000;\n
};\n    prng.double = prng;\n    // Mix the randomness into accumulated entropy.\n    mixkey(toString(arc4.S), pool);\n\n    // Calling convention: what to return as a function of prng, seed, is_math.\n    return (options.pass || callback ||\n
function(prng, seed, is_math_call, state) {\n        if (state) {\n            // Load the arc4 state from the given state if it has
an S array.\n            if (state.S) { copy(state, arc4); }\n            // Only provide the .state method if requested via
options.state.\n            prng.state = function() { return copy(arc4, {}); }\n        }\n        // If called as a method of
Math (Math.seedrandom()), mutate\n        // Math.random because that is how seedrandom.js has worked since
v1.0.\n        if (is_math_call) { math[rngname] = prng; return seed; }\n        // Otherwise, it is a newer calling
convention, so return the\n        // prng directly.\n        else return prng;\n    })\n    (\n    prng,\n    shortseed,\n    'global' in
options ? options.global : (this == math),\n    options.state);\n\n\n}\n\n\nmath['seed' + rngname] = seedrandom;\n\n\n\n//
ARC4\n\n\n// An ARC4 implementation. The constructor takes a key in the form of\n\n// an array of at most (width)
integers that should be 0 <= x < (width).\n\n\n// The g(count) method returns a pseudorandom integer that
concatenates\n\n// the next (count) outputs from ARC4. Its return value is a number x\n\n// that is in the range 0 <= x <
(width ^ count).\n\n\nfunction ARC4(key) {\n    var t, keylen = key.length,\n        me = this, i = 0, j = me.i = me.j = 0, s
= me.S = [];\n    // The empty key [] is treated as [0].\n    if (!keylen) { key = [keylen++]; }\n    // Set up S using the
standard key scheduling algorithm.\n    while (i < width) {\n        s[i] = i++;\n    }\n    for (i = 0; i < width; i++) {\n        s[i] =
s[j = mask & (j + key[i % keylen]) + (t = s[i])];\n        s[j] = t;\n    }\n    // The "g" method returns the next (count)
outputs as one number.\n    (me.g = function(count) {\n        // Using instance members instead of closure state nearly
doubles speed.\n        var t, r = 0,\n            i = me.i, j = me.j, s = me.S;\n        while (count-- > 0) {\n            t = s[i = mask & (i +
1)];\n            r = r * width + s[mask & ((s[i] = s[j = mask & (j + t)]) + (s[j] = t))];\n        }\n        me.i = i; me.j = j;\n        return
r;\n    })\n    // For robust unpredictability, the function call below automatically\n    // discards an initial batch of values.
This is called RC4-drop[256].\n    // See http://google.com/search?q=rsa+fluhrer+response&btnI\n
})(width);\n\n\n\n// copy()\n\n// Copies internal state of ARC4 to or from a plain object.\n\n\nfunction copy(f, t) {\n    t.i = f.i;\n    t.j = f.j;\n    t.S = f.S.slice();\n    return t;\n};\n\n\n// flatten()\n\n// Converts an object tree to nested arrays of
strings.\n\n\nfunction flatten(obj, depth) {\n    var result = [], typ = (typeof obj), prop;\n    if (depth && typ == 'object')
{\n        for (prop in obj) {\n            try { result.push(flatten(obj[prop], depth - 1)); } catch (e) {} }\n    }\n    return
(result.length ? result : typ == 'string' ? obj : obj + '\\0');\n\n\n\n// mixkey()\n\n// Mixes a string seed into a key that
is an array of integers, and\n\n// returns a shortened string seed that is equivalent to the result key.\n\n\nfunction
mixkey(seed, key) {\n    var stringseed = seed + "", smear, j = 0;\n    while (j < stringseed.length) {\n        key[mask & j]
= \n        mask & ((smear ^= key[mask & j] * 19) + stringseed.charCodeAt(j++));\n    }\n    return

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private mean: number;\n private stdDev: number;\n private nextVal: number;\n private dtype?: keyof
RandNormalDataTypes;\n private truncated?: boolean;\n private upper?: number;\n private lower?: number;\n
private random: seedrandom.prng;\n\n constructor(\n   mean: number, stdDeviation: number, dtype?: keyof
RandNormalDataTypes,\n   truncated?: boolean, seed?: number) {\n   this.mean = mean;\n   this.stdDev =
stdDeviation;\n   this.dtype = dtype;\n   this.nextVal = NaN;\n   this.truncated = truncated;\n   if (this.truncated)
{\n   this.upper = this.mean + this.stdDev * 2;\n   this.lower = this.mean - this.stdDev * 2;\n   }\n   const
seedValue = seed ? seed : Math.random();\n   this.random = seedrandom.alea(seedValue.toString());\n   }\n\n /**
Returns next sample from a Gaussian distribution. */\n public nextValue(): number {\n   if (!isNaN(this.nextVal))
{\n   const value = this.nextVal;\n   this.nextVal = NaN;\n   return value;\n   }\n\n   let resultX: number,
resultY: number;\n   let isValid = false;\n   while (!isValid) {\n   let v1: number, v2: number, s: number;\n   do
{\n   v1 = 2 * this.random() - 1;\n   v2 = 2 * this.random() - 1;\n   s = v1 * v1 + v2 * v2;\n   } while (s >=
1 || s === 0);\n\n   const mul = Math.sqrt(-2.0 * Math.log(s) / s);\n   resultX = this.mean + this.stdDev * v1 *
mul;\n   resultY = this.mean + this.stdDev * v2 * mul;\n\n   if (!this.truncated || this.isValidTruncated(resultX))
{\n   isValid = true;\n   }\n   }\n\n   if (!this.truncated || this.isValidTruncated(resultY)) {\n   this.nextVal =
this.convertValue(resultY);\n   }\n   return this.convertValue(resultX);\n   }\n\n /** Handles proper rounding for
non-floating-point numbers. */\n private convertValue(value: number): number {\n   if (this.dtype == null ||
this.dtype === 'float32') {\n   return value;\n   }\n   return Math.round(value);\n   }\n\n /** Returns true if less
than 2-standard-deviations from the mean. */\n private isValidTruncated(value: number): boolean {\n   return value
<= this.upper && value >= this.lower;\n   }\n}\n\n// Marsaglia, George, and Wai Wan Tsang. 2000. \"A Simple
Method for Generating\n// Gamma Variables.\"\n\nexport class RandGamma implements RandomGamma {\n private
alpha: number;\n private beta: number;\n private d: number;\n private c: number;\n private dtype?: keyof
RandGammaDataTypes;\n private randu: seedrandom.prng;\n private randn: MPRandGauss;\n\n constructor(\n
alpha: number, beta: number, dtype: keyof RandGammaDataTypes,\n   seed?: number) {\n   this.alpha = alpha;\n
this.beta = 1 / beta; // convert rate to scale parameter\n   this.dtype = dtype;\n\n   const seedValue = seed ? seed :
Math.random();\n   this.randu = seedrandom.alea(seedValue.toString());\n   this.randn = new MPRandGauss(0, 1,
dtype, false, this.randu());\n\n   if (alpha < 1) {\n   this.d = alpha + (2 / 3);\n   } else {\n   this.d = alpha - (1 /
3);\n   }\n   this.c = 1 / Math.sqrt(9 * this.d);\n   }\n\n /** Returns next sample from a gamma distribution. */\n
public nextValue(): number {\n   let x2: number, v0: number, v1: number, x: number, u: number, v: number;\n
while (true) {\n   do {\n   x = this.randn.nextValue();\n   v = 1 + (this.c * x);\n   } while (v <= 0);\n   v *=
v * v;\n   x2 = x * x;\n   v0 = 1 - (0.331 * x2 * x2);\n   v1 = (0.5 * x2) + (this.d * (1 - v + Math.log(v)));\n   u
= this.randu();\n   if (u < v0 || Math.log(u) < v1) {\n   break;\n   }\n   }\n   v = (1 / this.beta) * this.d * v;\n
if (this.alpha < 1) {\n   v *= Math.pow(this.randu(), 1 / this.alpha);\n   }\n   return this.convertValue(v);\n   }\n
\n /** Handles proper rounding for non-floating-point numbers. */\n private convertValue(value: number): number {\n
if (this.dtype === 'float32') {\n   return value;\n   }\n   return Math.round(value);\n   }\n}\n\nexport class
UniformRandom implements RandomBase {\n private min: number;\n private range: number;\n private random:
seedrandom.prng;\n private dtype?: keyof RandNormalDataTypes;\n\n constructor(\n   min = 0, max = 1, dtype?:
keyof RandNormalDataTypes,\n   seed?: string|number) {\n   this.min = min;\n   this.range = max - min;\n
this.dtype = dtype;\n   if (seed == null) {\n   seed = Math.random();\n   }\n   if (typeof seed === 'number') {\n
seed = seed.toString();\n   }\n\n   if (!this.canReturnFloat() && this.range <= 1) {\n   throw new Error(\n
`The difference between ${min} - ${max} <= 1 and dtype is not float`);\n   }\n   this.random =
seedrandom.alea(seed);\n   }\n\n /** Handles proper rounding for non floating point numbers. */\n private
canReturnFloat() => (this.dtype == null || this.dtype === 'float32');\n\n private convertValue(value:
number): number {\n   if (this.canReturnFloat()) {\n   return value;\n   }\n   return Math.round(value);\n   }\n\n
nextValue() {\n   return this.convertValue(this.min + this.range * this.random());\n   }\n}\n\nexport function
jarqueBeraNormalityTest(values: TypedArray|number[]) {\n //
https://en.wikipedia.org/wiki/Jarque%E2%80%93Bera\_test\n   const n = values.length;\n   const s =
skewness(values);\n   const k = kurtosis(values);\n   const jb = n / 6 * (Math.pow(s, 2) + 0.25 * Math.pow(k - 3, 2));\n
// JB test requires 2-degrees of freedom from Chi-Square @ 0.95;\n //

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http://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm\n const CHI_SQUARE_2DEG = 5.991;\n if
(jb > CHI_SQUARE_2DEG) {\n  throw new Error(`Invalid p-value for JB: ${jb}`);\n }\n}\n\nexport function
expectArrayInMeanStdRange(\n  actual: TypedArray|number[], expectedMean: number, expectedStdDev:
number,\n  epsilon?: number) {\n  if (epsilon == null) {\n    epsilon = testEpsilon();\n  }\n  const actualMean =
mean(actual);\n  expectNumbersClose(actualMean, expectedMean, epsilon);\n  expectNumbersClose(\n
standardDeviation(actual, actualMean), expectedStdDev, epsilon);\n}\n\nfunction mean(values:
TypedArray|number[]) {\n  let sum = 0;\n  for (let i = 0; i < values.length; i++) {\n    sum += values[i];\n  }\n  return
sum / values.length;\n}\n\nfunction standardDeviation(values: TypedArray|number[], mean: number) {\n  let
squareDiffSum = 0;\n  for (let i = 0; i < values.length; i++) {\n    const diff = values[i] - mean;\n    squareDiffSum
+= diff * diff;\n  }\n  return Math.sqrt(squareDiffSum / values.length);\n}\n\nfunction kurtosis(values:
TypedArray|number[]) {\n  // https://en.wikipedia.org/wiki/Kurtosis\n  const valuesMean = mean(values);\n  const n
= values.length;\n  let sum2 = 0;\n  let sum4 = 0;\n  for (let i = 0; i < n; i++) {\n    const v = values[i] -
valuesMean;\n    sum2 += Math.pow(v, 2);\n    sum4 += Math.pow(v, 4);\n  }\n  return (1 / n) * sum4 / Math.pow((1
/ n) * sum2, 2);\n}\n\nfunction skewness(values: TypedArray|number[]) {\n  //
https://en.wikipedia.org/wiki/Skewness\n  const valuesMean = mean(values);\n  const n = values.length;\n  let sum2
= 0;\n  let sum3 = 0;\n  for (let i = 0; i < n; i++) {\n    const v = values[i] - valuesMean;\n    sum2 += Math.pow(v,
2);\n    sum3 += Math.pow(v, 3);\n  }\n  return (1 / n) * sum3 / Math.pow((1 / (n - 1)) * sum2, 3 / 2);\n}\n\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {Tensor} from './tensor';\nimport {Rank, ShapeMap} from './types';\nimport {buffer} from
'/buffer';\nimport {op} from './operation';\nimport {RandGamma} from './rand_util';\n\n/**\n * Creates a `tf.Tensor`
with values sampled from a gamma distribution.\n *\n * ```js\n * tf.randomGamma([2, 2], 1).print();\n * ```\n *\n *
@param shape An array of integers defining the output tensor shape.\n * @param alpha The shape parameter of the
gamma distribution.\n * @param beta The inverse scale parameter of the gamma distribution. Defaults\n * to 1.\n *
@param dtype The data type of the output. Defaults to float32.\n * @param seed The seed for the random number
generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Random'}\n *\nfunction randomGamma<R extends
Rank>(\n  shape: ShapeMap[R], alpha: number, beta = 1,\n  dtype: 'float32'|'int32' = 'float32', seed?: number):
Tensor<R>\n  {\n    if (beta == null) {\n      beta = 1;\n    }\n    if (dtype == null) {\n      dtype = 'float32';\n    }\n    if (dtype !==
'float32' && dtype !== 'int32') {\n      throw new Error(`Unsupported data type ${dtype}`);\n    }\n    const rgamma =
new RandGamma(alpha, beta, dtype, seed);\n    const res = buffer(shape, dtype);\n    for (let i = 0; i < res.values.length;\n
i++) {\n      res.values[i] = rgamma.nextValue();\n    }\n    return res.toTensor();\n  }\n}\n\nexport const randomGamma =
op({randomGamma_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {buffer}
from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n * Creates a
`tf.Tensor` with values sampled from a normal distribution.\n *\n * ```js\n * tf.randomNormal([2, 2]).print();\n *
```*\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param mean The mean of the

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normal distribution.\n * @param stdDev The standard deviation of the normal distribution.\n * @param dtype The
data type of the output.\n * @param seed The seed for the random number generator.\n *\n * @doc {heading:
'Tensors', subheading: 'Random'}\n *\nfunction randomNormal_<R extends Rank>(\n shape: ShapeMap[R], mean
= 0, stdDev = 1, dtype?: 'float32'|'int32',\n seed?: number): Tensor<R> {\n if (dtype != null && (dtype as
DataType) === 'bool') {\n throw new Error(`Unsupported data type ${dtype}`);\n }\n const randGauss =\n new MPRandGauss(mean, stdDev, dtype, false /* truncated */, seed);\n const res = buffer(shape, dtype);\n for (let i
= 0; i < res.values.length; i++) {\n res.values[i] = randGauss.nextValue();\n }\n return
res.toTensor();\n}\n\nexport const randomNormal = op({randomNormal_});\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\n\nimport {buffer}
from './buffer';\nimport {op} from './operation';\nimport {UniformRandom} from './rand_util';\n\n/**\n * Creates a
`tf.Tensor` with values sampled from a uniform distribution.\n *\n * The generated values follow a uniform
distribution in the range [minval,\n * maxval). The lower bound minval is included in the range, while the upper\n *
bound maxval is excluded.\n *\n * ```js\n * tf.randomUniform([2, 2]).print();\n * ```\n *\n * @param shape An array
of integers defining the output tensor shape.\n * @param minval The lower bound on the range of random values to
generate.\n * Defaults to 0.\n * @param maxval The upper bound on the range of random values to generate.\n *
Defaults to 1.\n * @param dtype The data type of the output tensor. Defaults to 'float32'.\n *\n * @doc {heading:
'Tensors', subheading: 'Random'}\n *\nfunction randomUniform_<R extends Rank>(\n shape: ShapeMap[R],
minval = 0, maxval = 1, dtype: DataType = 'float32',\n seed?: number|string): Tensor<R> {\n const res =
buffer(shape, dtype);\n const random = new UniformRandom(minval, maxval, null, seed);\n for (let i = 0; i <
res.values.length; i++) {\n res.values[i] = random.nextValue();\n }\n return res.toTensor();\n}\n\nexport const
randomUniform = op({randomUniform_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from './engine';\nimport {Range, RangeAttrs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\n\n/**\n * Creates a new
`tf.Tensor1D` filled with the numbers in the range provided.\n *\n * The tensor is a is half-open interval meaning it
includes start, but\n * excludes stop. Decrementing ranges and negative step values are also\n * supported.\n *\n *
```js\n * tf.range(0, 9, 2).print();\n * ```\n *\n * @param start An integer start value\n * @param stop An
integer stop value\n * @param step An integer increment (will default to 1 or -1)\n * @param dtype The data type
of the output tensor. Defaults to 'float32'.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction range(\n  start: number, stop: number, step = 1,\n  dtype: 'float32'|'int32' = 'float32'): Tensor1D {\n  if
(step === 0) {\n    throw new Error(`Cannot have a step of zero`);\n  }\n\n  const attrs: RangeAttrs = {start, stop,
step, dtype};\n\n  return ENGINE.runKernel(Range, { /* inputs */, attrs as {} as NamedAttrMap);\n}\n\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable

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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Real, RealInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns the real part of a complex (or real) tensor.\n *\n * Given a tensor input, this operation returns a tensor of type float that is\n * the real part of each element in input considered as a complex number.\n *\n * If the input is real, it simply makes a clone.\n *\n * ```js\n * const x = tf.complex([-2.25, 3.25], [4.75, 5.75]);\n * tf.real(x).print();\n * ```\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\n * @function real_  
T extends Tensor>(input: T|TensorLike): T {\n *   const $input = convertToTensor(input, 'input', 'real');\n *   const inputs: RealInputs = {input: $input};\n *   return ENGINE.runKernel(Real, inputs as { } as NamedTensorMap);\n * }\n\nexport const real = op({real_});\n", "/*\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {Reciprocal, ReciprocalInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes reciprocal of x element-wise: `1 / x`\n *\n * ```js\n * const x = tf.tensor1d([0, 1, 2]);\n * x.reciprocal().print(); // or tf.reciprocal(x)\n * ```\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n * @function reciprocal_  
T extends Tensor>(x: T|TensorLike): T {\n *   const $x = convertToTensor(x, 'x', 'reciprocal');\n *   const inputs: ReciprocalInputs = {x: $x};\n *   return ENGINE.runKernel(Reciprocal, inputs as { } as NamedTensorMap);\n * }\n\nexport const reciprocal = op({reciprocal_});\n", "/*\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {ENGINE} from './engine';\nimport {Relu, ReluInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes rectified linear element-wise: `max(x, 0)`\n *\n * ```js\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n * x.relu().print(); // or tf.relu(x)\n * ```\n *\n * @param x The input tensor. If the dtype is `bool`, the output dtype will be\n * `int32`.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n * @function relu_  
T extends Tensor>(x: T|TensorLike): T {\n *   const $x = convertToTensor(x, 'x', 'relu');\n *   const inputs: ReluInputs = {x: $x};\n *   return ENGINE.runKernel(Relu, inputs as { } as NamedTensorMap);\n * }\n\nexport const relu = op({relu_});\n", "/*\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
```

implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Relu6, Relu6Inputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes rectified linear 6 element-wise:  $\min(\max(x, 0), 6)$ \n * \n * const x = tf.tensor1d([-1, 2, -3, 8]);\n * \n * x.relu6().print(); // or tf.relu6(x)\n * \n * @param x The input tensor. If the dtype is `bool`, the output dtype will be\n * `int32`.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction relu6_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'relu6');\n  const inputs: Relu6Inputs = {x: $x};\n  return ENGINE.runKernel(Relu6, inputs as { } as NamedTensorMap);\n}\n\nexport const relu6 = op({relu6_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Reverse, ReverseAttrs, ReverseInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Reverses a `tf.Tensor` along a specified axis.\n * \n * Also available are stricter rank-specific methods that assert that `x` is\n * of the given rank:\n * - `tf.reverse1d`\n * - `tf.reverse2d`\n * - `tf.reverse3d`\n * - `tf.reverse4d`\n * \n * Except `tf.reverse1d` (which does not have axis param), all methods have\n * same signature as this method.\n * \n * const x = tf.tensor1d([1, 2, 3, 4]);\n * \n * x.reverse().print();\n * \n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * \n * const axis = 1;\n * \n * x.reverse(axis).print();\n * \n * @param x The input tensor to be reversed.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-rank(x), rank(x)]. Defaults to all axes.\n * \n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction reverse_<T extends Tensor>(x: T|TensorLike, axis?: number|number[]): T {\n  const $x = convertToTensor(x, 'x', 'reverse');\n  const inputs: ReverseInputs = {x: $x};\n  const attrs: ReverseAttrs = {dims: axis};\n  return ENGINE.runKernel(Reverse, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const reverse = op({reverse_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor1D`.\n * \n * @param x The input tensor.\n */\nfunction reverse1d_(x: Tensor1D|TensorLike): Tensor1D {\n  const $x = convertToTensor(x, 'x', 'reverse');\n  util.assert($x.rank === 1, () => `Error in reverse1D: x must be rank 1 but got rank ${$x.rank}.`);\n  return reverse($x, 0);\n}\n\nexport const reverse1d = op({reverse1d_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor2D` along a specified axis.\n *\n * @param x The input tensor.\n *\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)]. Defaults to all axes.\n *\n * @function reverse2d(x: Tensor2D|TensorLike, axis?: number|number[]): Tensor2D {\n const $x =\n convertToTensor(x, 'x', 'reverse');\n util.assert(\n   $x.rank === 2,\n   () => `Error in reverse2D: x must be rank 2\n but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse2d = op({reverse2d});\n\n"/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor3D` along a specified axis.\n *\n * @param x The input tensor.\n *\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)]. Defaults to all axes.\n *\n * @function reverse3d(x: Tensor3D|TensorLike, axis?: number|number[]): Tensor3D {\n const $x =\n convertToTensor(x, 'x', 'reverse');\n util.assert(\n   $x.rank === 3,\n   () => `Error in reverse3D: x must be rank 3\n but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse3d = op({reverse3d});\n\n"/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor4D` along a specified axis.\n *\n * @param x The input tensor.\n *\n * @param axis The set of dimensions to reverse. Must be in the\n *   range [-rank(x), rank(x)]. Defaults to all axes.\n *\n * @function reverse4d(x: Tensor4D|TensorLike, axis?: number|number[]): Tensor4D {\n const $x =\n convertToTensor(x, 'x', 'reverse');\n util.assert(\n   $x.rank === 4,\n   () => `Error in reverse4D: x must be rank 4\n but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse4d = op({reverse4d});\n\n"/**\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */\n\n
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*\n\nimport {ENGINE} from './engine';\nimport {Round, RoundInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
round of input `tf.Tensor` element-wise: `round(x)`.\n * It implements banker's rounding.\n * \n * `const x =
tf.tensor1d([.6, 1.1, -3.3]);\n * x.round().print(); // or tf.round(x)\n * \n * @param x The input tensor.\n * \n *
@doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction round_<T extends Tensor>(x:
T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'round');\n  const inputs: RoundInputs = {x: $x};\n  \n  return
ENGINE.runKernel(Round, inputs as { } as NamedTensorMap);\n}\n\nexport const round = op({round_});\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from './engine';\nimport {Rsqrt, RsqrtInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
reciprocal of square root of the input `tf.Tensor` element-wise:\n * `y = 1 / sqrt(x)`.\n * \n * `const x =
tf.tensor1d([1, 2, 4, -1]);\n * x.rsqrt().print(); // or tf.rsqrt(x)\n * \n * @param x The input tensor.\n * \n *
@doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction rsqrt_<T extends Tensor>(x: T|TensorLike):
T {\n  const $x = convertToTensor(x, 'x', 'rsqrt');\n  \n  const inputs: RsqrtInputs = {x: $x};\n  \n  return
ENGINE.runKernel(Rsqrt, inputs as { } as NamedTensorMap);\n}\n\nexport const rsqrt = op({rsqrt_});\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {Scalar} from './tensor';\nimport {DataType} from './types';\nimport {isTypedArray} from
 './util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-0 `tf.Tensor` (scalar) with the
provided value and dtype.\n * \n * The same functionality can be achieved with `tf.tensor`, but in general\n * we
recommend using `tf.scalar` as it makes the code more readable.\n * \n * `tf.scalar(3.14).print();\n * \n * \n * @param value The value of the scalar.\n * @param dtype The data type.\n * \n * @doc {heading: 'Tensors',
subheading: 'Creation'}\n *\nexport function scalar(\n  value: number|boolean|string|Uint8Array, dtype?:
DataType): Scalar {\n  if (((isTypedArray(value) && dtype !== 'string') || Array.isArray(value)) &&\n    dtype !==
'complex64') {\n    throw new Error(\n      'Error creating a new Scalar: value must be a primitive ' +\n      '\n      (number|boolean|string)');\n  }\n  if (dtype === 'string' && isTypedArray(value) &&\n    !(value instanceof
Uint8Array)) {\n    throw new Error(\n      'When making a scalar from encoded string, ' +\n      '\n      the value must be
`Uint8Array`.');\n  }\n  const shape: number[] = [];\n  const inferredShape: number[] = [];\n  return
makeTensor(value, shape, inferredShape, dtype) as Scalar;\n}\n", "/**\n * \n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {ENGINE} from './engine';\nimport {Selu, SeluInputs} from './kernel_names';\nimport {Tensor} from
 './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
 scaled exponential linear element-wise.\n *  $x < 0 ? \text{scale} * \alpha * (\exp(x) - 1) : x$ \n * tf.tensor1d([-1, 2, -3, 4]);\n * x.selu().print(); // or tf.selu(x)\n * @param x The input tensor.\n *
 @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction selu<T extends Tensor>(x: T|TensorLike):
 T {\n  const $x = convertToTensor(x, 'x', 'selu');\n\n  const inputs: SeluInputs = {x: $x};\n\n  return
 ENGINE.runKernel(Selu, inputs as { } as NamedTensorMap);\n\n  export const selu = op({selu_});\n"}/**\n *
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 copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
=====

```

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=====
*\n\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\n\nimport {conv2d} from './conv2d';\nimport
 {depthwiseConv2d} from './depthwise_conv2d';\nimport {op} from './operation';\nimport {reshape} from
 './reshape';\n\n/**\n * 2-D convolution with separable filters.\n * Performs a depthwise convolution that acts
 separately on channels followed\n * by a pointwise convolution that mixes channels. Note that this is\n *
 separability between dimensions [1, 2] and 3, not spatial separability\n * between dimensions 1 and 2.\n * See\n *
 [https://www.tensorflow.org/api\_docs/python/tf/nn/separable\_conv2d](\n *
 https://www.tensorflow.org/api\_docs/python/tf/nn/separable\_conv2d)\n * for more details.\n *
 @param x The input tensor, of rank 4 or rank 3, of shape\n *   [batch, height, width, inChannels]. If rank 3, batch of 1 is\n *
 assumed.\n * @param depthwiseFilter The depthwise filter tensor, rank 4, of shape\n *   [filterHeight, filterWidth,
 inChannels, channelMultiplier]. This is\n *   the filter used in the first step.\n * @param pointwiseFilter The
 pointwise filter tensor, rank 4, of shape\n *   [1, 1, inChannels * channelMultiplier, outChannels]. This is\n *
 the filter used in the second step.\n * @param strides The strides of the convolution: [strideHeight,\n *
 strideWidth]. If strides is a single number, then `strideHeight ==\n * strideWidth`. \n * @param pad The type of
 padding algorithm.\n * - `same`: output will be of same size as input,\n *   regardless of filter size.\n *
 - `valid`: output will be smaller than input if filter is larger\n *   than 1x1.\n * - For more info, see this
 guide:\n *   [https://www.tensorflow.org/api\_guides/python/nn#Convolution](\n *
 https://www.tensorflow.org/api\_guides/python/nn#Convolution)\n *
 @param dilations The dilation rates:\n *   [dilationHeight, dilationWidth]\n *   in which we sample input values across the height and width dimensions\n *
 in atrous convolution. Defaults to [1, 1]. If `rate` is a single\n *   number, then `dilationHeight ==
 dilationWidth`. If it is greater than\n *   1, then all values of `strides` must be 1.\n * @param dataFormat: An
 optional string from: "NHWC", "NCHW". Defaults to\n *   "NHWC". Specify the data format of the input and
 output data. With the\n *   default format "NHWC", the data is stored in the order of: [batch,\n *   height, width,
 channels]. Only "NHWC" is currently supported.\n *
 @doc {heading: 'Operations', subheading:
 'Convolution'}\n *\nfunction separableConv2d<T extends Tensor3D|Tensor4D>(\n  x: T|TensorLike,
 depthwiseFilter: Tensor4D|TensorLike,\n  pointwiseFilter: Tensor4D|TensorLike, strides: [number,
 number]|number,\n  pad: 'valid'|'same', dilation: [number, number]|number = [1, 1],\n  dataFormat:
 'NHWC'|'NCHW' = 'NHWC'): T {\n  const $x = convertToTensor(x, 'x', 'separableConv2d');\n  const
 $depthwiseFilter =\n    convertToTensor(depthwiseFilter, 'depthwiseFilter', 'separableConv2d');\n  const
 $pointwiseFilter =\n    convertToTensor(pointwiseFilter, 'pointwiseFilter', 'separableConv2d');\n  let x4D = $x as
 Tensor4D;\n  let reshapedTo4D = false;\n  if ($x.rank === 3) {\n    reshapedTo4D = true;\n    x4D = reshape($x, [1,
 $x.shape[0], $x.shape[1], $x.shape[2]]);\n  }\n  if (dataFormat === 'NCHW') {\n    throw new Error(\n

```



```

'separableConv2d currently does not support dataFormat NCHW; only ' +\n      'NHWC is supported');\n } \n\n
util.assert(\n      x4D.rank === 4,\n      () => `Error in separableConv2d: input must be rank 4, but got ` +\n
`rank ${x4D.rank}.`);\n util.assert(\n      $depthwiseFilter.rank === 4,\n      () => `Error in separableConv2d:
depthwise filter must be rank 4, but ` +\n      `got rank ${$depthwiseFilter.rank}.`);\n util.assert(\n
$pointwiseFilter.rank === 4,\n      () => `Error in separableConv2d: pointwise filter must be rank 4, but ` +\n
`got rank ${$depthwiseFilter.rank}.`);\n util.assert(\n      $pointwiseFilter.shape[0] === 1,\n      () =>\n      `Error
in separableConv2d: the first dimension of pointwise filter ` +\n      ` must be 1, but got
${$pointwiseFilter.shape[0].`);\n util.assert(\n      $pointwiseFilter.shape[1] === 1,\n      () => `Error in
separableConv2d: the second dimension of pointwise ` +\n      `filter must be 1, but got
${$pointwiseFilter.shape[1].`);\n\n const inChannels = $depthwiseFilter.shape[2];\n const channelMultiplier =
$depthwiseFilter.shape[3];\n util.assert(\n      $pointwiseFilter.shape[2] === inChannels * channelMultiplier,\n      ()
=>\n      `Error in separableConv2d: the third dimension of pointwise filter ` +\n      ` must be ${inChannels *
channelMultiplier}, ` +\n      `but got ${$pointwiseFilter.shape[2].`);\n\n const depthwise = depthwiseConv2d(\n
      x4D, $depthwiseFilter, strides, pad, dataFormat, dilation);\n const pointwiseStride = 1;\n const res =\n
conv2d(depthwise, $pointwiseFilter, pointwiseStride, 'valid', dataFormat);\n\n if (reshapedTo4D) {\n      return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n } \n return res as T;\n }\n\n\nexport const
separableConv2d = op({separableConv2d_});\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {Tensor, TensorBuffer} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\n/**\n * Computes the difference between two lists of
numbers.\n *\n * Given a Tensor `x` and a Tensor `y`, this operation returns a Tensor `out`\n * that represents all
values that are in `x` but not in `y`. The returned\n * Tensor `out` is sorted in the same order that the numbers appear
in `x`\n * (duplicates are preserved). This operation also returns a Tensor indices that\n * represents the position of
each out element in `x`. In other words:\n *\n * `out[i] = x[idxx[i]]` for i in [0, 1, ..., out.length - 1]\n *\n * ```js\n *
const x = [1, 2, 3, 4, 5, 6];\n * const y = [1, 3, 5];\n *\n * const [out, indices] = await tf.setdiff1dAsync(x, y);\n *
out.print(); // [2, 4, 6]\n * indices.print(); // [1, 3, 5]\n *\n * @param x 1-D Tensor. Values to keep.\n *
@param y 1-D Tensor. Must have the same type as x. Values to exclude in the\n *      output.\n * @returns Promise
of Tensor tuple [out, indices].\n * out: Tensor with the same type as x.\n * indices: A Tensor of type int32.\n *\n *
@doc {heading: 'Tensors', subheading: 'Transformations'}\n */\n\n@async function setdiff1dAsync_ (\n      x:
Tensor|TensorLike, y: Tensor|TensorLike): Promise<[Tensor, Tensor]> {\n      const $x = convertToTensor(x, 'x',
'setdiff1d');\n      const $y = convertToTensor(y, 'y', 'setdiff1d');\n\n      util.assert(\n          $x.dtype === $y.dtype,\n          () =>
`x and y should have the same dtype, but got x (${x.dtype}) and y (${y.dtype}).`);\n\n      util.assert(\n          $x.rank === 1, () => `x should be 1D tensor, but got x (${x.shape}).`);\n      util.assert(\n          $y.rank === 1, () => `y
should be 1D tensor, but got y (${y.shape}).`);\n\n      const xVals = await $x.data();\n      const yVals = await
$y.data();\n      const ySet = new Set(yVals);\n      let outputSize = 0;\n      for (let i = 0; i < xVals.length; i++) {\n          if
(!ySet.has(xVals[i])) {\n              outputSize++;\n          }\n      }\n      const buffer = new TensorBuffer([outputSize],
$x.dtype);\n      const indices = new TensorBuffer([outputSize], 'int32');\n      for (let i = 0, p = 0; i < xVals.length; i++)
{\n          if (!ySet.has(xVals[i])) {\n              buffer.values[p] = xVals[i];\n              indices.values[p] = i;\n              p++;\n          }\n      }\n      return [buffer.toTensor(), indices.toTensor()];\n }\n\n\nexport const setdiff1dAsync = setdiff1dAsync_;\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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 * limitations under the License.

```
=====  
 *  
 * \n\nimport {ENGINE} from './engine';\nimport {Sign, SignInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**  
 * Returns an element-wise indication of the sign of a number.  
 * \n * ``js  
 * const x = tf.tensor1d([.6, 1.1, -3.3, NaN, 0]);  
 * \n * x.sign().print(); // or tf.sign(x)  
 * \n * @param x The input Tensor.  
 * \n * @doc {heading: 'Operations',\n subheading: 'Basic math'}  
 * \n * \nfunction sign_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =\n  convertToTensor(x, 'x', 'sign');\n  const inputs: SignInputs = {x: $x};\n  return ENGINE.runKernel(Sign, inputs as\n  {} as NamedTensorMap);\n}\n\nexport const sign = op({sign_});  
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
 * See the License for the specific language governing permissions and  
 * limitations under the License.
```

```
=====  
 *  
 * \n\nimport {ENGINE} from './engine';\nimport {Sin, SinInputs} from './kernel_names';\nimport {Tensor} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**  
 * Computes sin of the input Tensor element-wise:  
 * `sin(x)`  
 * \n * ``js  
 * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);  
 * \n * x.sin().print(); // or tf.sin(x)  
 * \n * @param x The input tensor.  
 * \n * @doc {heading: 'Operations',\n subheading: 'Basic math'}  
 * \n * \nfunction sin_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =\n  convertToTensor(x, 'x', 'sin');\n  const inputs: SinInputs = {x: $x};\n  return ENGINE.runKernel(Sin, inputs as\n  {} as NamedTensorMap);\n}\n\nexport const sin = op({sin_});  
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
 * See the License for the specific language governing permissions and  
 * limitations under the License.
```

```
=====  
 *  
 * \n\nimport {ENGINE} from './engine';\nimport {Sinh, SinhInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**  
 * Computes hyperbolic sin of the input `tf.Tensor` element-wise:  
 * `sinh(x)`  
 * \n * ``js  
 * const x = tf.tensor1d([0, 1, -1, .7]);  
 * \n * x.sinh().print(); // or tf.sinh(x)  
 * \n * @param x The input tensor.  
 * \n * @doc {heading: 'Operations',\n subheading: 'Basic math'}  
 * \n * \nfunction sinh_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =\n  convertToTensor(x, 'x', 'sinh');\n  const inputs: SinhInputs = {x: $x};\n  return ENGINE.runKernel(Sinh, inputs as\n  {} as NamedTensorMap);\n}\n\nexport const sinh = op({sinh_});  
 * \n * \n * @license  
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
 * See the License for the specific language governing permissions and  
 * limitations under the License.
```

```

=====
*\n\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 1D slice from 1D array starting at coordinates `begin` and is\n * of length `size`. See
 `slice` for details.\n *\nfunction slice1d_(\n  x: Tensor1D|TensorLike, begin: number, size: number): Tensor1D {\n
const $x = convertToTensor(x, 'x', 'slice1d');\n  util.assert(\n    $x.rank === 1,\n    () =>\n      `slice1d expects a
rank-1 tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x, [begin], [size]);\n}\n\nexport const slice1d =
op({slice1d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 2D slice from a 2D array starting at coordinates `begin` and\n * is of size `size`. See
 `slice` for details.\n *\nfunction slice2d_(\n  x: Tensor2D|TensorLike, begin: [number, number],\n  size: [number,
number]): Tensor2D {\n  const $x = convertToTensor(x, 'x', 'slice2d');\n  util.assert(\n    $x.rank === 2,\n    ()
=>\n      `slice2d expects a rank-2 tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x, begin,
size);\n}\n\nexport const slice2d = op({slice2d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 3D slice from a 3D array starting at coordinates `begin` and\n * is of size `size`. See
 `slice` for details.\n *\nfunction slice3d_(\n  x: Tensor3D|TensorLike, begin: [number, number, number],\n  size:
[number, number, number]): Tensor3D {\n  const $x = convertToTensor(x, 'x', 'slice3d');\n  util.assert(\n    $x.rank
=== 3,\n    () =>\n      `slice3d expects a rank-3 tensor, but got a rank-${$x.rank} tensor`);\n  return slice($x,
begin, size);\n}\n\nexport const slice3d = op({slice3d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {slice} from
 './slice';\n\n/**\n * Extracts a 4D slice from a 4D array starting at coordinates `begin` and\n * is of size `size`. See
 `slice` for details.\n *\nfunction slice4d_(\n  x: Tensor4D|TensorLike, begin: [number, number, number,
number],\n  size: [number, number, number, number]): Tensor4D {\n  const $x = convertToTensor(x, 'x',

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'slice4d');\n util.assert(\n    $x.rank === 4,\n    () =>\n        `slice4d expects a rank-4 tensor, but got a rank-\n        ${$x.rank} tensor`);\n return slice($x, begin, size);\n}\n\nexport const slice4d = op({ slice4d_ });\n", "/*\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {ENGINE} from '../engine';\nimport {Softmax, SoftmaxAttrs, SoftmaxInputs} from\n '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport\n {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Computes the softmax normalized vector\n * given the logits.\n * @param {TensorLike} logits\n * @param {number} dim The dimension softmax would be performed on.\n * Defaults to -1 which indicates the last dimension.\n * @doc {heading: 'Operations', subheading:\n * 'Normalization'}\n */\nfunction softmax<T extends Tensor>(logits: T | TensorLike, dim = -1): T {\n  const $logits =\n    convertToTensor(logits, 'logits', 'softmax', 'float32');\n  if (dim === -1) {\n    dim = $logits.rank - 1;\n  }\n  if (dim\n    !== $logits.rank - 1) {\n    throw Error(\n      `Softmax along a non-last dimension is not yet supported. ` +\n      `Logits was rank ${$logits.rank} and dim was ${dim}`);\n  }\n  const inputs: SoftmaxInputs = {logits: $logits};\n  const attrs: SoftmaxAttrs = {dim};\n  return ENGINE.runKernel(\n    Softmax, inputs as {} as\n    NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const softmax = op({ softmax_ });\n", "/*\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {ENGINE} from '../engine';\nimport {FFT, FFTInputs} from '../kernel_names';\nimport {Tensor}\n from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {assert} from '../util';\nimport\n {op} from '../operation';\n\n/**\n * Fast Fourier transform.\n * Computes the 1-dimensional discrete Fourier\n * transform over the inner-most\n * dimension of input.\n * @param {Tensor} input The complex input to compute an fft over.\n * @doc {heading: 'Operations', subheading:\n * 'Spectral', namespace: 'spectral'}\n */\nfunction fft_(input: Tensor): Tensor {\n  assert(\n    input.dtype ===\n    'complex64',\n    () => `The dtype for tf.spectral.fft() must be complex64 ` +\n    `but got ${input.dtype}.`);\n  const inputs: FFTInputs = {input};\n  return ENGINE.runKernel(FFT, inputs as {} as\n    NamedTensorMap);\n}\n\nexport const fft = op({ fft_ });\n", "/*\n *\n * @license\n * Copyright 2020 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport {ENGINE} from '../engine';\nimport {IFFT, IFFTInputs} from '../kernel_names';\nimport {Tensor}
```


`numOrSizeSplits` is a number, splits `x` along dimension `axis` into `numOrSizeSplits` smaller tensors.
 Requires that `numOrSizeSplits` evenly divides `x.shape[axis]`.
 If `numOrSizeSplits` is a number array, splits `x` into `numOrSizeSplits.length` pieces. The shape of the `i`-th piece has the same size as `x` except along dimension `axis` where the size is `numOrSizeSplits[i]`.
`const x = tf.tensor2d([1, 2, 3, 4, 5, 6, 7, 8], [2, 4]);`
`const [a, b] = tf.split(x, 2, 1);`
`a.print();`
`b.print();`
`const [c, d, e] = tf.split(x, [1, 2, 1], 1);`
`c.print();`
`d.print();`
`e.print();`
`@param x` The input tensor to split.
`@param numOrSizeSplits` Either an integer indicating the number of splits along the axis or an array of integers containing the sizes of each output tensor along the axis. If a number then it must evenly divide `x.shape[axis]`; otherwise the sum of sizes must match `x.shape[axis]`.
 Can contain one -1 indicating that dimension is to be inferred.
`@param axis` The dimension along which to split. Defaults to 0 (the first dimension).
`@doc {heading: 'Tensors', subheading: 'Slicing and Joining'}`
`function split_<T extends Tensor>(x: Tensor|TensorLike, numOrSizeSplits: number[]|number, axis = 0): T[]`
`{`
 `const $x = convertToTensor(x, 'x', 'split');`
 `const inputs: SplitVInputs = {x: $x};`
 `const attr: SplitVAttrs = {numOrSizeSplits, axis};`
 `return ENGINE.runKernel(SplitV, inputs as {} as NamedTensorMap, attr as {} as NamedAttrMap) as T[];`
`}`
`export const split = op({split_});`
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```

=====
import {Tensor} from './tensor';
import {assert} from './util';
import {complex} from './complex';
import {concat} from './concat';
import {imag} from './imag';
import {op} from './operation';
import {real} from './real';
import {reshape} from './reshape';
import {slice} from './slice';
import {split} from './split';
import {zeros} from './zeros';
import {zerosLike} from './zeros_like';
import {fft} from './fft';

/**
 * Real value input fast Fourier transform.
 * Computes the 1-dimensional discrete Fourier transform over the inner-most dimension of the real input.
 * const real = tf.tensor1d([1, 2, 3]);
 * real.rfft().print();
 * @param input The real value input to compute an rfft over.
 * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}
 * function rfft_(input: Tensor, fftLength?: number): Tensor {
 *   assert(input.dtype === 'float32', () => `The dtype for rfft() must be real value but got ${input.dtype}`);
 *   let innerDimensionSize = input.shape[input.shape.length - 1];
 *   const batch = input.size / innerDimensionSize;
 *   let adjustedInput: Tensor;
 *   if (fftLength != null && fftLength < innerDimensionSize) {
 *     // Need to crop
 *     const begin = input.shape.map(v => 0);
 *     const size = input.shape.map(v => v);
 *     size[input.shape.length - 1] = fftLength;
 *     adjustedInput = slice(input, begin, size);
 *     innerDimensionSize = fftLength;
 *   } else if (fftLength != null && fftLength > innerDimensionSize) {
 *     // Need to pad with zeros
 *     const zerosShape = input.shape.map(v => v);
 *     zerosShape[input.shape.length - 1] = fftLength - innerDimensionSize;
 *     adjustedInput = concat([input, zeros(zerosShape)], input.shape.length - 1);
 *     innerDimensionSize = fftLength;
 *   } else {
 *     adjustedInput = input;
 *   }
 *   // Complement the input with zero imaginary numbers.
 *   const zerosInput = zerosLike(adjustedInput);
 *   const complexInput = reshape(complex(adjustedInput, zerosInput), [batch, innerDimensionSize]);
 *   const ret = fft(complexInput);
 *   // Exclude complex conjugations. These conjugations are put symmetrically.
 *   const half = Math.floor(innerDimensionSize / 2) + 1;
 *   const realValues = real(ret);
 *   const imagValues = imag(ret);
 *   const realComplexConjugate = split(realValues, [half, innerDimensionSize - half], realValues.shape.length - 1);
 *   const imagComplexConjugate = split(imagValues, [half, innerDimensionSize - half], imagValues.shape.length - 1);
 *   const outputShape = adjustedInput.shape.slice();
 *   outputShape[adjustedInput.shape.length - 1] = half;
 *   return reshape(complex(realComplexConjugate[0], imagComplexConjugate[0]), outputShape);
 * }
 * export const rfft = op({rfft_});
  
```

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limitations under the License.

```
=====  
import {ENGINE} from '../engine';  
import {Sqrt, SqrtInputs} from '../kernel_names';  
import {Tensor} from '../tensor';  
import {NamedTensorMap} from '../tensor_types';  
import {convertToTensor} from '../tensor_util_env';  
import {TensorLike} from '../types';  
import {op} from './operation';  
  
/**  
 * Computes square root of the input `tf.Tensor` element-wise:  
 *  $y = \sqrt{x}$   
 * const x = tf.tensor1d([1, 2, 4, -1]);  
 * x.sqrt().print(); // or tf.sqrt(x)  
 * @param x The input tensor.  
 * @doc {heading: 'Operations', subheading: 'Basic math'}  
 */  
function sqrt<T extends Tensor>(x: T|TensorLike): T {  
  const $x = convertToTensor(x, 'x', 'sqrt');  
  const inputs: SqrtInputs = {x: $x};  
  return ENGINE.runKernel(Sqrt, inputs as NamedTensorMap);  
}  
export const sqrt = op({sqrt});  
=====  
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```

```
=====  
import {ENGINE} from '../engine';  
import {SquaredDifference, SquaredDifferenceInputs} from '../kernel_names';  
import {Tensor} from '../tensor';  
import {NamedTensorMap} from '../tensor_types';  
import {makeTypesMatch} from '../tensor_util';  
import {convertToTensor} from '../tensor_util_env';  
import {TensorLike} from '../types';  
import {assertAndGetBroadcastShape} from './broadcast_util';  
import {op} from './operation';  
  
/**  
 * Returns (a - b) * (a - b) element-wise.  
 * Supports broadcasting.  
 * const a = tf.tensor1d([1, 4, 3, 16]);  
 * const b = tf.tensor1d([1, 2, 9, 4]);  
 * a.squaredDifference(b).print(); // or  
 * tf.squaredDifference(a, b)  
 * const a = tf.tensor1d([2, 4, 6, 8]);  
 * const b = tf.scalar(5);  
 * a.squaredDifference(b).print(); // or  
 * tf.squaredDifference(a, b)  
 * @param a The first tensor.  
 * @param b The second tensor. Must have the same type as `a`.  
 * @doc {heading: 'Operations', subheading: 'Arithmetic'}  
 */  
function squaredDifference<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {  
  let $a = convertToTensor(a, 'a', 'squaredDifference');  
  let $b = convertToTensor(b, 'b', 'squaredDifference');  
  [$a, $b] = makeTypesMatch($a, $b);  
  assertAndGetBroadcastShape($a.shape, $b.shape);  
  const inputs: SquaredDifferenceInputs = {a: $a, b: $b};  
  const attrs = {};  
  return ENGINE.runKernel(SquaredDifference, inputs as unknown as NamedTensorMap, attrs);  
}  
export const squaredDifference = op({squaredDifference});  
=====  
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```

```
=====  
import {Tensor} from '../tensor';  
import {convertToTensor} from '../tensor_util_env';  
import {TensorLike} from '../types';  
import {squeezeShape} from './util';  
import {op} from './operation';  
import {reshape} from './reshape';  
  
/**  
 * Removes dimensions of size 1 from the shape of a `tf.Tensor`.  
 * const x =  
 */
```

```
tf.tensor([1, 2, 3, 4], [1, 1, 4]);\n * x.squeeze().print();\n * ```\n * \n * @param x The input tensor to be squeezed.\n * @param axis An optional list of numbers. If specified, only\n * squeezes the dimensions listed. The dimension index starts at 0. It\n * is an error to squeeze a dimension that is not 1.\n * \n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n * \nfunction squeeze_<T extends Tensor>(x: Tensor|TensorLike, axis?: number[]): T {\n  const $x = convertToTensor(x, 'x', 'squeeze');\n  return reshape($x, squeezeShape($x.shape, axis).newShape) as T;\n}\n\nexport const squeeze = op({squeeze_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Pack, PackAttrs, PackInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensorArray} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * Stacks a list of rank-`R` `tf.Tensor`s into one rank-`(R+1)` `tf.Tensor`.\n * \n * \n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.stack([a, b, c]).print();\n * ```\n * \n * @param tensors A list of tensor objects with the same shape and dtype.\n * @param axis The axis to stack along. Defaults to 0 (the first dim).\n * \n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n * \nfunction stack_<T extends Tensor>(\n  tensors: Array<T|TensorLike>, axis = 0): Tensor {\n  const $tensors =\n    convertToTensorArray(tensors, 'tensors', 'stack', 'string_or_numeric');\n  util.assert(\n    $tensors.length >= 1, () => 'Pass at least one tensor to tf.stack');\n  if ($tensors.length > 0) {\n    util.assert(\n      axis <= $tensors[0].rank, () => 'Axis must be <= rank of the tensor');\n  }\n  const inputs: PackInputs = $tensors;\n  const attrs: PackAttrs = {axis};\n  return ENGINE.runKernel(\n    Pack, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const stack = op({stack_});\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Step, StepAttrs, StepInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes step of the input `tf.Tensor` element-wise: `x > 0 ? 1 : alpha * x`.\n * \n * \n * const x = tf.tensor1d([0, 2, -1, -3]);\n * x.step(.5).print(); // or tf.step(x, .5)\n * ```\n * \n * @param x The input tensor.\n * @param alpha The gradient when input is negative.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n * \nfunction step_<T extends Tensor>(x: T|TensorLike, alpha = 0.0): T {\n  const $x = convertToTensor(x, 'x', 'step');\n  const inputs: StepInputs = {x: $x};\n  const attrs: StepAttrs = {alpha};\n  return ENGINE.runKernel(\n    Step, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const step = op({step_});\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
```


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```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {StridedSlice, StridedSliceAttrs, StridedSliceInputs} from\n './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport\n {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport\n {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Extracts a strided slice of a tensor.\n *\n * Roughly speaking, this op extracts a slice of size (end-begin)/stride from\n * the given input tensor (x). Starting at\n * the location specified by begin the\n * slice continues by adding stride to the index until all dimensions are not\n * less than end. Note that a stride can be negative, which causes a reverse\n * slice.\n *\n *`js\n * const t =\n tf.tensor3d([1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6],\n * [3, 2, 3]);\n * t.stridedSlice([1, 0, 0], [2, 1, 3], [1, 1,\n 1]).print() // [[[3, 3, 3]]]\n * t.stridedSlice([1, 0, 0], [2, 2, 3], [1, 1, 1]).print() // [[[3, 3, 3],\n * [4, 4, 4]]]\n * t.stridedSlice([1, -1, 0], [2, -3, 3], [1, -1, 1]).print() // [[[4, 4, 4],\n * [3, 3, 3]]]\n *\n * @param x The tensor to stride slice.\n * @param begin The coordinates to start\n the slice from.\n * @param end: The coordinates to end the slice at.\n * @param strides: The size of the slice.\n * @param beginMask: If the ith bit of beginMask is set, begin[i] is ignored\n * and the fullest possible range in\n that dimension is used instead.\n * @param endMask: If the ith bit of endMask is set, end[i] is ignored\n * and\n the fullest possible range in that dimension is used instead.\n * @param shrinkAxisMask: a bitmask where bit i\n implies that\n * the ith specification should shrink the dimensionality. begin and end must\n * imply a slice of size 1\n in the dimension.\n *\n * @doc {heading: 'Operations', subheading: 'Slicing and Joining'}\n\nfunction\n stridedSlice_(\n x: Tensor|TensorLike, begin: number[], end: number[], strides?: number[],\n beginMask = 0,\n endMask = 0, ellipsisMask = 0, newAxisMask = 0,\n shrinkAxisMask = 0): Tensor {\n const $x =\n convertToTensor(x, 'x', 'stridedSlice');\n\n const inputs: StridedSliceInputs = {x: $x};\n const attrs:\n StridedSliceAttrs = {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n };\n\n return ENGINE.runKernel(\n StridedSlice, inputs as { } as\n NamedTensorMap,\n attrs as { } as NamedAttrMap);\n}\n\nexport const stridedSlice =\n op({stridedSlice_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n
```

```
=====\n\n*\n\nimport {ENGINE} from './engine';\nimport {Tan, TanInputs} from './kernel_names';\nimport {Tensor} from\n './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes\n tan of the input `tf.Tensor` element-wise, `tan(x)`\n *\n *`js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n * x.tan().print(); // or tf.tan(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading:\n 'Operations', subheading: 'Basic math'}\n\nfunction tan_<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n convertToTensor(x, 'x', 'tan');\n\n const inputs: TanInputs = {x: $x};\n\n return ENGINE.runKernel(Tan, inputs as\n { } as NamedTensorMap);\n}\n\nexport const tan = op({tan_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```

=====
*\n\nimport {Tensor1D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike1D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-1 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor1d` as it makes
the code more readable.\n *\n * ```js\n * tf.tensor1d([1, 2, 3]).print();\n * ```\n *\n * @param values The values of
the tensor. Can be array of numbers,\n *     or a `TypedArray`.\n * @param dtype The data type.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n *\nexport function tensor1d(values: TensorLike1D, dtype?:
DataType): Tensor1D {\n  assertNonNull(values);\n  const inferredShape = inferShape(values, dtype);\n  if
(inferredShape.length !== 1) {\n    throw new Error('tensor1d() requires values to be a flat/TypedArray');\n  }\n
const shape: number[] = null;\n  return makeTensor(values, shape, inferredShape, dtype) as Tensor1D;\n}\n\n",/**\n
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```

```

=====
*\n\nimport {Tensor2D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike2D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-2 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor2d` as it makes
the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor2d([[1, 2], [3, 4]]).print();\n * ```\n *
```js\n * // Pass a flat array and specify a shape.\n * tf.tensor2d([1, 2, 3, 4], [2, 2]).print();\n * ```\n *\n * @param
values The values of the tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n *
@param shape The shape of the tensor. If not provided, it is inferred from\n * `values`.\n * @param dtype The
data type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nexport function tensor2d(\n values:
TensorLike2D, shape?: [number, number],\n dtype?: DataType): Tensor2D {\n assertNonNull(values);\n if
(shape !== null && shape.length !== 2) {\n throw new Error('tensor2d() requires shape to have two numbers');\n
 }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 2 && inferredShape.length !===
1) {\n throw new Error(\n 'tensor2d() requires values to be number[][] or flat/TypedArray');\n }\n if
(inferredShape.length === 1 && shape === null) {\n throw new Error(\n 'tensor2d() requires shape to be
provided when `values` +\n `are a flat/TypedArray');\n }\n return makeTensor(values, shape, inferredShape,
dtype) as Tensor2D;\n}\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport {Tensor4D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike4D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-4 `tf.Tensor` with the provided values, shape and dtype.\n *\n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor4d` as it makes
the code more readable.\n *\n * ```js\n * // Pass a nested array.\n * tf.tensor4d([[[[1], [2]], [[3], [4]]]]).print();\n *
```js\n * // Pass a flat array and specify a shape.\n * tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]).print();\n * ```\n *\n *
@param values The values of the tensor. Can be nested array of numbers,\n *     or a flat array, or a `TypedArray`.\n *

```

```

* @param shape The shape of the tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param
dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n * ^\nexport function tensor4d(\n
values: TensorLike4D, shape?: [number, number, number, number],\n dtype?: DataType): Tensor4D {\n
assertNonNull(values);\n if (shape != null && shape.length !== 4) {\n throw new Error('tensor4d() requires shape
to have four numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 4
&& inferredShape.length !== 1) {\n throw new Error(\n 'tensor4d() requires values to be number[][][] or
flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n throw new Error(\n
'tensor4d() requires shape to be provided when `values` '+\n 'are a flat array');\n }\n return makeTensor(values,
shape, inferredShape, dtype) as Tensor4D;\n }\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\n\nimport {Tensor5D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike5D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-5 `tf.Tensor` with the provided values, shape and dtype.\n * \n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor5d` as it makes
the code more readable.\n * \n * ```js\n * // Pass a nested array.\n *
tf.tensor5d([[[[[1],[2]],[3],[4]],[[5],[6]],[7],[8]]]]).print();\n * ```\n * // Pass a flat array and specify a
shape.\n * tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]).print();\n * ```\n * \n * @param values The values of the
tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the
tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param dtype The data type.\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n * ^\nexport function tensor5d(\n values: TensorLike5D, shape?:
[number, number, number, number, number],\n dtype?: DataType): Tensor5D {\n
assertNonNull(values);\n if (shape != null && shape.length !== 5) {\n throw new Error('tensor5d() requires shape to have five numbers');\n
}\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 5 && inferredShape.length !==
1) {\n throw new Error(\n 'tensor5d() requires values to be '+\n 'number[][][] or flat/TypedArray');\n
}\n if (inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor5d() requires shape to be
provided when `values` '+\n 'are a flat array');\n }\n return makeTensor(values, shape, inferredShape, dtype) as
Tensor5D;\n }\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {Tensor6D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike6D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-6 `tf.Tensor` with the provided values, shape and dtype.\n * \n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor6d` as it makes
the code more readable.\n * \n * ```js\n * // Pass a nested array.\n *
tf.tensor6d([[[[[[1],[2]],[3],[4]],[[5],[6]],[7],[8]]]]]).print();\n * ```\n * // Pass a flat array and specify a
shape.\n * tf.tensor6d([1, 2, 3, 4, 5, 6, 7, 8], [1, 1, 2, 2, 2, 1]).print();\n * ```\n * \n * @param values The values of the
tensor. Can be nested array of numbers,\n * or a flat array, or a `TypedArray`.\n * @param shape The shape of the

```

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tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param dtype The data type.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n *
\nexport function tensor6d(\n  values: TensorLike6D,\n  shape?:
[number, number, number, number, number, number],\n  dtype?: DataType): Tensor6D {\n
assertNonNull(values);\n if (shape != null && shape.length !== 6) {\n  throw new Error('tensor6d() requires shape
to have six numbers');\n }\n const inferredShape = inferShape(values, dtype);\n if (inferredShape.length !== 6 &&
inferredShape.length !== 1) {\n  throw new Error(\n    'tensor6d() requires values to be number[][][][][] or '+\n
'flat/TypedArray');\n }\n if (inferredShape.length === 1 && shape == null) {\n  throw new Error(\n
'tensor6d() requires shape to be provided when `values` '+\n    'are a flat array');\n }\n shape = shape ||\n
inferredShape as [number, number, number, number, number, number];\n return makeTensor(values, shape,
inferredShape, dtype) as Tensor6D;\n }\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
\n
*\n\nimport {ENGINE} from '../engine';\nimport {TopK, TopKAttrs, TopKInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
 '../types';\n\nimport {op} from './operation';\n\n/**\n * Finds the values and indices of the `k` largest entries along
the last\n * dimension.\n * If the input is a vector (rank=1), finds the k largest entries in the vector\n * and
outputs their values and indices as vectors. Thus values[j] is the j-th\n * largest entry in input, and its index is
indices[j].\n * For higher rank inputs, computes the top k entries along the last dimension.\n *\n * If two elements
are equal, the lower-index element appears first.\n *\n * `js\n * const a = tf.tensor2d([[1, 5], [4, 3]]);\n * const
{values, indices} = tf.topk(a);\n * values.print();\n * indices.print();\n *\n * `*\n * @param x 1-D or higher `tf.Tensor`
with last dimension being at least `k`.\n * @param k Number of top elements to look for along the last dimension.\n
*\n * @param sorted If true, the resulting `k` elements will be sorted by the\n * values in descending order.\n *\n *
@doc {heading: 'Operations', subheading: 'Evaluation'}\n *\nfunction topk<T extends Tensor>(\n  x:
T|TensorLike, k = 1, sorted = true): {values: T, indices: T} {\n  const $x = convertToTensor(x, 'x', 'topk');\n  if
($x.rank === 0) {\n    throw new Error('topk() expects the input to be of rank 1 or higher');\n  }\n  const lastDim =
$x.shape[$x.shape.length - 1];\n  if (k > lastDim) {\n    throw new Error(\n      `k` passed to topk() must be <= the
last dimension (${lastDim})` +\n      `but got ${k}`);\n  }\n  const inputs: TopKInputs = {x: $x};\n  const attrs:
TopKAttrs = {k, sorted};\n  const [values, indices] = ENGINE.runKernel(\n    TopK, inputs as {} as
NamedTensorMap, attrs as {} as NamedAttrMap);\n  return {values, indices} as {values: T, indices:
T};\n }\n\n\nexport const topk = op({topk_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
\n
*\n\nimport {Tensor} from '../tensor';\nimport {DataType, Rank, ShapeMap} from '../types';\n\nimport {buffer}
from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n * Creates a
`tf.Tensor` with values sampled from a truncated normal\n * distribution.\n *\n * `js\n * tf.truncatedNormal([2,
2]).print();\n *\n * `*\n * The generated values follow a normal distribution with specified mean and\n * standard
deviation, except that values whose magnitude is more than 2\n * standard deviations from the mean are dropped

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and re-picked.\n * @param shape An array of integers defining the output tensor shape.\n * @param mean The mean of the normal distribution.\n * @param stdDev The standard deviation of the normal distribution.\n * @param dtype The data type of the output tensor.\n * @param seed The seed for the random number generator.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction truncatedNormal_<R extends Rank>(\n shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',\n seed?: number): Tensor<R> {\n if (dtype != null && (dtype as DataType) === 'bool') {\n throw new Error(`Unsupported data type \$ { dtype }`);\n }\n const randGauss =\n new MPRandGauss(mean, stdDev, dtype, true /* truncated */, seed);\n const res = buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = randGauss.nextValue();\n }\n return res.toTensor();\n}\n\nexport const truncatedNormal = op({truncatedNormal_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

=====
*\n\nimport {ENGINE} from '../engine';\nimport {Unique, UniqueAttrs, UniqueInputs} from\n '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor, Tensor1D} from\n '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\nimport {op} from\n '../operation';\n\n/*\n * Finds unique elements along an axis of a tensor.\n * It returns a tensor `values`\n * containing all of the unique elements along the\n * `axis` of the given tensor `x` in the same order that they occur\n * along the\n * `axis` in `x`; `x` does not need to be sorted. It also returns a tensor\n * `indices` the same size as the\n * number of the elements in `x` along the `axis`\n * dimension. It contains the index in the unique output `values`.\n *\n * ``js\n * // A 1-D tensor\n * const a = tf.tensor1d([1, 1, 2, 4, 4, 4, 7, 8, 8]);\n * const {values, indices} =\n * tf.unique(a);\n * values.print(); // [1, 2, 4, 7, 8, 8]\n * indices.print(); // [0, 0, 1, 2, 2, 2, 3, 4, 4]\n *\n * ``\n *\n * // A 2-D tensor with axis=0\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0, 0]]\n * const a =\n * tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);\n * const {values, indices} = tf.unique(a, 0);\n * values.print(); // [[1, 0,\n * // [2, 0, 0]]\n * indices.print(); // [0, 0, 1]\n *\n * ``\n *\n * // A 2-D tensor with axis=1\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0, 0]]\n * const a = tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0,\n * // [1, 0],\n * // [1, 0],\n * // [2, 0]]);\n * const {values, indices} = tf.unique(a, 1);\n * values.print(); // [[1, 0],\n * // [1, 0],\n * // [2, 0]]\n * indices.print(); // [0, 1, 1]\n *\n * @param x A tensor (int32, string, bool).\n * @param axis The axis of the tensor to find the unique elements.\n * @returns [uniqueElements, indices] (see above for details)\n *\n * @doc {heading: 'Operations', subheading: 'Evaluation'}\n */\nfunction unique_<T extends Tensor>(\n x:\n T|TensorLike, axis = 0): {values: T, indices: Tensor1D} {\n const $x = convertToTensor(x, 'x', 'unique',\n 'string_or_numeric');\n assert($x.rank > 0, () => 'The input tensor must be at least 1D');\n\n const inputs:\n UniqueInputs = {x: $x};\n const attrs: UniqueAttrs = {axis};\n const [values, indices] = ENGINE.runKernel(\n Unique, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap) as [T,\n Tensor1D];\n return {values, indices};\n}\n\nexport const unique = op({unique_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```

=====
*\n\nimport {ENGINE} from '../engine';\nimport {UnsortedSegmentSum, UnsortedSegmentSumAttrs,\n UnsortedSegmentSumInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
```

```

{Tensor, Tensor1D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, isInt} from
 './util';\nimport {op} from './operation';\n\n**\n * Computes the sum along segments of a `tf.Tensor`.\n *\n * `js`\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const segmentIds = tf.tensor1d([1, 2, 0, 1], 'int32');\n * const
numSegments = 3;\n *\n * x.unsortedSegmentSum(segmentIds, numSegments).print()\n * //or
tf.unsortedSegmentSum(x, segmentIds, numSegments)\n * ``\n * @param x The `tf.Tensor` that will be summed
along its segments.\n * @param segmentIds A `tf.Tensor1D` whose rank is equal to the rank of `x`'s\n * dimension
along the `axis`. Maps each element of `x` to a segment.\n * @param numSegments The number of distinct
`segmentIds`.\n *\n * @doc {heading: 'Operations', subheading: 'Segment'}\n *\nfunction
unsortedSegmentSum<T extends Tensor>(\n  x: T|TensorLike, segmentIds: Tensor1D|TensorLike, numSegments:
number): T {\n  const $x = convertToTensor(x, 'x', 'unsortedSegmentSum');\n  const $segmentIds =\n  convertToTensor(segmentIds, 'segmentIds', 'unsortedSegmentSum', 'int32');\n  assert(isInt(numSegments), () =>
'numSegments must be of dtype int');\n  const inputs: UnsortedSegmentSumInputs = {x: $x, segmentIds:
$segmentIds};\n  const attrs: UnsortedSegmentSumAttrs = {numSegments};\n  return ENGINE.runKernel(\n
UnsortedSegmentSum, inputs as {} as NamedTensorMap,\n  attrs as {} as NamedAttrMap);\n}\n\nexport const
unsortedSegmentSum = op({unsortedSegmentSum_});\n", "**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ENGINE} from './engine';\nimport {Unpack, UnpackAttrs, UnpackInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\n\n**\n * Unstacks a
`tf.Tensor` of rank-`R` into a list of rank-`(R-1)` `tf.Tensor`s.\n *\n * `js`\n * const a = tf.tensor2d([1, 2, 3, 4], [2,
2]);\n *\n * tf.unstack(a).forEach(tensor => tensor.print());\n * ``\n *\n * @param x A tensor object.\n * @param
axis The axis to unstack along. Defaults to 0 (the first dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing
and Joining'}\n *\nfunction unstack_(x: Tensor|TensorLike, axis = 0): Tensor[] {\n  const $x = convertToTensor(x,
'x', 'unstack', 'string_or_numeric');\n  util.assert(\n    axis >= -$x.shape.length && axis < $x.shape.length,\n    ()
=>\n      `Axis = ${axis} is not in [-${$x.shape.length}, ${$x.shape.length}]`);\n  const inputs: UnpackInputs =
{value: $x};\n  const attrs: UnpackAttrs = {axis};\n  return ENGINE.runKernel(\n    Unpack, inputs as {} as
NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const unstack = op({unstack_});\n", "**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {ENGINE} from './engine';\nimport {Tensor, Variable} from './tensor';\nimport {DataType, Rank}
 from './types';\n\n**\n * Creates a new variable with the provided initial value.\n * `js`\n * const x =
tf.variable(tf.tensor([1, 2, 3]));\n * x.assign(tf.tensor([4, 5, 6]));\n *\n * x.print();\n * ``\n *\n * @param initialValue
Initial value for the tensor.\n * @param trainable If true, optimizers are allowed to update it.\n * @param name
Name of the variable. Defaults to a unique id.\n * @param dtype If set, initialValue will be converted to the given
type.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nexport function variable<R extends Rank>(\n

```



```

*\n * @param tensor N-D tensor.\n * @param mask K-D boolean tensor, K <= N and K must be known statically.\n
* @param axis A 0-D int Tensor representing the axis in tensor to mask from.\n * By default, axis is 0 which will
mask from the first dimension.\n * Otherwise K + axis <= N.\n *\n * @doc {heading: 'Tensors', subheading:
'Slicing and Joining'}\n */\n\nfunction booleanMaskAsync_(\n  tensor: Tensor|TensorLike, mask:
Tensor|TensorLike,\n  axis?: number): Promise<Tensor> {\n  const $tensor = convertToTensor(tensor, 'tensor',
'boolMask');\n  const $mask = convertToTensor(mask, 'mask', 'boolMask', 'bool');\n\n  const axisFrom = axis == null
? 0 : axis;\n  const maskDim = $mask.rank;\n  const tensorShape = $tensor.shape;\n\n  util.assert(maskDim > 0, ()
=> 'mask cannot be scalar');\n  util.assertShapesMatch(\n    tensorShape.slice(axisFrom, axisFrom + maskDim),
$mask.shape,\n    `mask's shape must match the first K dimensions of tensor's shape,`);\n\n  let leadingSize = 1;\n  for (let i = axisFrom; i < axisFrom + maskDim; i++) {\n    leadingSize *= tensorShape[i];\n  }\n  const
targetTensorShape =\n    tensorShape.slice(0, axisFrom)\n    .concat([leadingSize], tensorShape.slice(axisFrom
+ maskDim));\n  const reshapedTensor = reshape($tensor, targetTensorShape);\n  const reshapedMask =
reshape($mask, [-1]);\n  const positivePositions = await whereAsync(reshapedMask);\n  const indices =
squeeze(positivePositions, [1]);\n\n  const res = gather(reshapedTensor, indices, axisFrom);\n\n  // Ensure no
memory leak.\n  if (tensor !== $tensor) {\n    $tensor.dispose();\n  }\n  if (mask !== $mask) {\n    $mask.dispose();\n
  }\n  indices.dispose();\n  reshapedTensor.dispose();\n  reshapedMask.dispose();\n  positivePositions.dispose();\n\n
return res;\n}\n\nexport const booleanMaskAsync = booleanMaskAsync_;\n", "/**\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { Tensor } from './tensor';\nimport { convertToTensor } from './tensor_util_env';\nimport { TensorLike }
from './types';\nimport { parseAxisParam } from './util';\nimport { abs } from './abs';\nimport * as axis_util from
 './axis_util';\nimport { max } from './max';\nimport { min } from './min';\nimport { op } from './operation';\nimport
 { pow } from './pow';\nimport { reshape } from './reshape';\nimport { scalar } from './scalar';\nimport { sqrt } from
 './sqrt';\nimport { square } from './square';\nimport { sum } from './sum';\n\n/**\n * Computes the norm of scalar,
vectors, and matrices.\n * This function can compute several different vector norms (the 1-norm, the\n * Euclidean
or 2-norm, the inf-norm, and in general the p-norm for p > 0)\n * and matrix norms (Frobenius, 1-norm, and inf-
norm).\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * x.norm().print(); // or tf.norm(x)\n * ```\n *\n *
@param x The input array.\n * @param ord Optional. Order of the norm. Supported norm types are\n * following:\n
*\n * | ord      | norm for matrices      | norm for vectors\n * |-----|-----|-----|\n
* | 'euclidean' | Frobenius norm      | 2-norm\n * | 'fro'    | Frobenius norm\t      | Infinity
|max(sum(abs(x), axis=1)) | max(abs(x))\n * | -Infinity | min(sum(abs(x), axis=1)) | min(abs(x))\n * | 1
|max(sum(abs(x), axis=0)) | sum(abs(x))\n * | 2      |          | sum(abs(x)^2)^1/2*\n *\n * @param axis
Optional. If axis is null (the default), the input is\n * considered a vector and a single vector norm is computed over
the entire\n * set of values in the Tensor, i.e. norm(x, ord) is equivalent\n * to norm(x.reshape([-1]), ord). If axis is a
integer, the input\n * is considered a batch of vectors, and axis determines the axis in x\n * over which to compute
vector norms. If axis is a 2-tuple of integer it is\n * considered a batch of matrices and axis determines the axes in
NDArray\n * over which to compute a matrix norm.\n * @param keepDims Optional. If true, the norm have the
same dimensionality\n * as the input.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n */\n\nfunction
norm_(\n  x: Tensor|TensorLike, ord: number|'euclidean'|'fro' = 'euclidean',\n  axis: number|number[] = null,
keepDims = false): Tensor {\n  x = convertToTensor(x, 'x', 'norm');\n  const norm = normImpl(x, ord, axis);\n  let
keepDimsShape = norm.shape;\n  if (keepDims) {\n    const axes = parseAxisParam(axis, x.shape);\n    keepDimsShape =
axis_util.expandShapeToKeepDim(norm.shape, axes);\n  }\n  return reshape(norm,
keepDimsShape);\n}\n\nfunction normImpl(\n  x: Tensor, p: number|string, axis: number|number[] = null): Tensor

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{\n if (x.rank === 0) {\n   return abs(x);\n }\n\n // consider vector when no axis is specified\n if (x.rank !== 1 &&\n axis === null) {\n   return normImpl(reshape(x, [-1]), p, axis);\n }\n\n // vector\n if (x.rank === 1 || typeof axis\n === 'number' ||\n   Array.isArray(axis) && axis.length === 1) {\n   if (p === 1) {\n     return sum(abs(x), axis);\n   }\n   if (p === Infinity) {\n     return max(abs(x), axis);\n   }\n   if (p === -Infinity) {\n     return min(abs(x),\n axis);\n   }\n   if (p === 'euclidean' || p === 2) {\n     // norm(x, 2) = sum(abs(xi) ^ 2) ^ 1/2\n     return\n sqrt(sum(pow(abs(x), scalar(2, 'int32')), axis));\n   }\n\n   throw new Error(`Error in norm: invalid ord value:\n ${p}`);\n }\n\n // matrix (assumption axis[0] < axis[1])\n if (Array.isArray(axis) && axis.length === 2) {\n   if (p\n === 1) {\n     return max(sum(abs(x), axis[0]), axis[1] - 1);\n   }\n   if (p === Infinity) {\n     return\n max(sum(abs(x), axis[1]), axis[0]);\n   }\n   if (p === -Infinity) {\n     return min(sum(abs(x), axis[1]), axis[0]);\n   }\n   if (p === 'fro' || p === 'euclidean') {\n     // norm(x) = sqrt(sum(pow(x, 2)))\n     return sqrt(sum(square(x),\n axis));\n   }\n\n   throw new Error(`Error in norm: invalid ord value: ${p}`);\n }\n\n throw new Error(`Error in\n norm: invalid axis: ${axis}`);\n}\n\nexport const norm = op({norm_});\n", "/**\n * @license\n * Copyright 2018\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {Scalar, Tensor} from './tensor';\nimport {assertTypesMatch} from './tensor_util';\nimport\n {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from\n './util';\n\nimport {add} from './add';\nimport {div} from './div';\nimport {mul} from './mul';\nimport {op} from\n './operation';\nimport {pow} from './pow';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\n/**\n * Compute the moving average of a variable.\n * Without zeroDebias, the moving average operation is defined\n by:\n *  $v += \delta$  where\n *  $\delta = (1 - \text{decay}) * (x - v)$ \n * With zeroDebias (default), the  $\delta$  term\n is scaled to debias the\n * effect of the (assumed) zero-initialization of  $v$ .\n *  $\delta /= (1 - \text{decay} ^ \text{step})$ \n * For more details on the zero-debiasing algorithm, see:\n * https://arxiv.org/abs/1412.6980\n * Note that this\n function is completely stateless and does not keep track of\n * step count. The step count needs to be maintained by\n the caller and passed\n * in as `step`.\n * @param v The current moving average value.\n * @param x New\n input value, must have the same shape and dtype as  $v$ .\n * @param decay The decay factor. Typical values are\n 0.95 and 0.99.\n * @param step Step count.\n * @param zeroDebias: Whether zeroDebias is to be performed\n (default: `true`).\n * @returns The new moving average value.\n * @doc {heading: 'Operations', subheading:\n 'Moving Average'}\n */\nfunction movingAverage_<T extends Tensor>(\n  v: T|TensorLike, x: T|TensorLike,\n  decay: number|Scalar,\n  step?: number|Scalar, zeroDebias = true): T {\n  const $v = convertToTensor(v, 'v',\n 'movingAverage');\n  const $x = convertToTensor(x, 'x', 'movingAverage');\n  const $decay =\n convertToTensor(decay, 'decay', 'movingAverage');\n\n  assertTypesMatch($v, $x);\n  util.assert(\n util.arraysEqual($v.shape, $x.shape), () => 'Shape mismatch in v and x');\n\n  const one = scalar(1);\n  const\n oneMinusDecay = sub(one, $decay);\n\n  let update = mul(sub($x, $v), oneMinusDecay);\n  if (zeroDebias) {\n    util.assert(\n      step != null, () => 'When using zeroDebias: true, step is required.);\n    const $step =\n convertToTensor(step, 'step', 'movingAverage');\n    update = div(update, sub(one, pow($decay, $step))); \n  }\n  return add($v, update);\n}\n\nexport const movingAverage = op({movingAverage_});\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {ENGINE} from './engine';\nimport {ScatterNd, ScatterNdAttrs, ScatterNdInputs} from
 './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
 {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank,
 ShapeMap, TensorLike} from './types';\n\nimport {op} from './operation';\nimport * as scatter_nd_util from
 './scatter_nd_util';\n\n/**\n * Creates a new tensor by applying sparse updates to individual\n * values or slices
 within a zero tensor of the given shape tensor according to\n * indices. This operator is the inverse of the
 `tf.gatherND` operator which\n * extracts values or slices from a given tensor.\n * \n * `js\n * const indices =
 tf.tensor2d([4, 3, 1, 7], [4, 1], 'int32');\n * const updates = tf.tensor1d([9, 10, 11, 12]);\n * const shape = [8];\n *
 tf.scatterND(indices, updates, shape).print() // [0, 11, 0, 10, 9, 0, 0, 12]\n * \n * @param indices The tensor
 contains the indices into the output tensor.\n * @param updates The tensor contains the value for the indices.\n *
 @param shape: The shape of the output tensor.\n * @doc {heading: 'Operations', subheading: 'Slicing and
 Joining'}\n */\nfunction scatterND<R extends Rank>(\n  indices: Tensor|TensorLike, updates:
 Tensor|TensorLike,\n  shape: ShapeMap[R]): Tensor<R> {\n  const $indices = convertToTensor(indices, 'indices',
 'scatterND', 'int32');\n  const $updates = convertToTensor(updates, 'updates', 'scatterND');\n
  scatter_nd_util.validateInput($updates, $indices, shape);\n\n  const inputs: ScatterNdInputs = {indices: $indices,
 updates: $updates};\n  const attrs: ScatterNdAttrs = {shape};\n\n  // tslint:disable-next-line: no-unnecessary-type-
assertion\n  return ENGINE.runKernel(\n    ScatterNd, inputs as {} as NamedTensorMap,\n    attrs as {}
 as NamedAttrMap) as Tensor<R>;\n}\n\nexport const scatterND = op({scatterND});\n", "/*\n * @license\n *
 Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
 agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
=====\n\n*\nimport {Tensor} from './tensor';\n\n/**\n * Validate sparseToDense inputs.\n * \n * @param sparseIndices A 0-
D, 1-D, or 2-D Tensor of type int32.\n * sparseIndices[i] contains the complete index where sparseValues[i] will
 be\n * placed.\n * @param sparseValues A 0-D or 1-D Tensor. Values\n * corresponding to each row of
 sparseIndices, or a scalar value to be used for\n * all sparse indices.\n * @param outputShape number[]. Shape of
 the dense output tensor.\n * @param validateIndices boolean. indice validation is not supported, error\n * will be
 thrown if it is set.\n */\nexport function validateInput(\n  sparseIndices: Tensor, sparseValues: Tensor,\n
  outputShape: number[],\n  defaultValues: Tensor) {\n  if (sparseIndices.dtype !== 'int32') {\n    throw new Error(\n
      'tf.sparseToDense() expects the indices to be int32 type,' +\n      ` but the dtype was ${sparseIndices.dtype}.`);\n
  }\n  if (sparseIndices.rank > 2) {\n    throw new Error(\n      'sparseIndices should be a scalar, vector, or matrix,' +\n
      ` but got shape ${sparseIndices.shape}.`);\n  }\n\n  const numElems = sparseIndices.rank > 0 ?
 sparseIndices.shape[0] : 1;\n  const numDims = sparseIndices.rank > 1 ? sparseIndices.shape[1] : 1;\n\n  if
 (outputShape.length !== numDims) {\n    throw new Error(\n      'outputShape has incorrect number of elements:,'\n
      +\n      ` ${outputShape.length}, should be: ${numDims}.`);\n  }\n\n  const numValues = sparseValues.size;\n  if
 (!(sparseValues.rank === 0 ||\n    sparseValues.rank === 1 && numValues === numElems)) {\n    throw new
 Error(\n      'sparseValues has incorrect shape ' +\n      ` ${sparseValues.shape}, should be [] or
 [${numElems}]`);\n  }\n\n  if (sparseValues.dtype !== defaultValues.dtype) {\n    throw new
 Error('sparseValues.dtype must match defaultValues.dtype');\n  }\n}\n", "/*\n * @license\n *
 Copyright 2018
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

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*\n
*\n\nimport {ENGINE} from './engine';\nimport {SparseToDense, SparseToDenseAttrs, SparseToDenseInputs}
from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport * as sparse_to_dense from
 './ops/sparse_to_dense_util';\nimport {Scalar, Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, ScalarLike, ShapeMap,
TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Converts a sparse representation into a
dense tensor.\n * Builds an array dense with shape outputShape such that:\n * // If sparseIndices is scalar\n *
dense[i] = (i == sparseIndices ? sparseValues : defaultValue)\n * // If sparseIndices is a vector, then for each i\n
* dense[sparseIndices[i]] = sparseValues[i]\n * // If sparseIndices is an n by d matrix, then for each i in [0, n)\n
* dense[sparseIndices[i][0], ..., sparseIndices[i][d-1]] = sparseValues[i]\n * All other values in dense are set to
defaultValue. If sparseValues is a\n * scalar, all sparse indices are set to this single value.\n * If indices are
repeated the final value is summed over all values for those\n * indices.\n * ```\n * const indices =
tf.tensor1d([4, 5, 6, 1, 2, 3], 'int32');\n * const values = tf.tensor1d([10, 11, 12, 13, 14, 15], 'float32');\n * const shape
= [8];\n * tf.sparseToDense(indices, values, shape).print();\n * ```\n * @param sparseIndices A 0-D, 1-D, or 2-D
Tensor of type int32.\n * sparseIndices[i] contains the complete index where sparseValues[i] will be\n * placed.\n *
@param sparseValues A 0-D or 1-D Tensor. Values\n * corresponding to each row of sparseIndices, or a scalar
value to be used for\n * all sparse indices.\n * @param outputShape Shape of the dense output tensor. the type is
inferred.\n * @param defaultValue Scalar. Value to set for indices not specified in\n * sparseIndices. Defaults to
zero.\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n *\nfunction sparseToDense_<R> extends
Rank>(\n  sparseIndices: Tensor|TensorLike, sparseValues: Tensor|TensorLike,\n  outputShape: ShapeMap[R],
defaultValue: Scalar|ScalarLike = 0): Tensor<R> {\n  const $sparseIndices =\n    convertToTensor(sparseIndices,
'sparseIndices', 'sparseToDense', 'int32');\n  const $sparseValues =\n    convertToTensor(sparseValues,
'sparseValues', 'sparseToDense');\n  const $defaultValue = convertToTensor(\n    defaultValue, 'defaultValue',
'sparseToDense', $sparseValues.dtype);\n\n  sparse_to_dense.validateInput(\n    $sparseIndices, $sparseValues,
outputShape, $defaultValue);\n\n  const inputs: SparseToDenseInputs = {\n    sparseIndices: $sparseIndices,\n
sparseValues: $sparseValues,\n    defaultValue: $defaultValue\n  };\n\n  const attrs: SparseToDenseAttrs =
{outputShape};\n\n  return ENGINE.runKernel(\n    SparseToDense, inputs as {} as NamedTensorMap,\n    attrs
as {} as NamedAttrMap);\n}\n\nexport const sparseToDense = op({sparseToDense_});\n", "/**\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*\n
*\n\nimport {ENGINE} from './engine';\nimport {GatherNd, GatherNdInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
 './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Gather slices
from input tensor into a Tensor with shape specified by\n * `indices`. \n * `indices` is an K-dimensional integer
tensor, best thought of as a\n * (K-1)-dimensional tensor of indices into input, where each element defines a\n * slice
of input:\n * output[\\(i_0, ..., i_{K-2}\\)] = input[indices[\\(i_0, ..., i_{K-2}\\)]]\n * Whereas in `tf.gather`,
`indices` defines slices into the first dimension of\n * input, in `tf.gatherND`, `indices` defines slices into the first N
dimensions\n * of input, where N = indices.shape[-1].\n * The last dimension of indices can be at most the rank
of input:\n * indices.shape[-1] <= input.rank\n * The last dimension of `indices` corresponds to elements\n * (if
indices.shape[-1] == input.rank) or slices\n * (if indices.shape[-1] < input.rank) along dimension indices.shape[-1]
of\n * input.\n * The output tensor has shape\n * indices.shape[:-1] + input.shape[indices.shape[-1]:]\n * Note
that on CPU, if an out of bound index is found, an error is returned. On\n * GPU, if an out of bound index is found,
a 0 is stored in the corresponding\n * output value.\n * ```\n * const indices = tf.tensor2d([0, 1, 1, 0], [2,2],
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const inTopKAsync = inTopKAsync_;\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\nimport {ENGINE} from './engine';\nimport {Conv2DBackpropFilter, Conv2DBackpropFilterAttrs,
Conv2DBackpropFilterInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor3D, Tensor4D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from
'./util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes the derivative of the filter of a 2D convolution.\n *\n * @param x The input tensor,
of rank 4 or rank 3 of shape\n * [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param
dy The dy image, of rank 4 or rank 3, of shape\n * [batch, height, width, outDepth]. If rank 3, batch of 1 is
assumed.\n * @param filterShape The shape of the filter, length 4,\n * [filterHeight, filterWidth, inDepth,
outDepth].\n * @param strides The strides of the convolution: [strideHeight,\n * strideWidth].\n * @param pad A
string from: 'same', 'valid'. The type of padding algorithm\n * used in the forward prop of the op.\n * @param
dataFormat: An optional string from: \"NHWC\", \"NCHW\". Defaults to\n * \"NHWC\". Specify the data format
of the input and output data. With the\n * default format \"NHWC\", the data is stored in the order of: [batch,\n *
height, width, channels].\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n *
provided, it will default to truncate.\n */\nfunction conv2DBackpropFilter_<T extends Tensor3D|Tensor4D>(\n x:
T, dy: T, filterShape: [number, number, number, number],\n strides: [number, number],\n number,\n pad:
'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n
dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\n let x4D = x as Tensor4D;\n if (x.rank === 3) {\n x4D =
reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n }\n let dy4D = dy as Tensor4D;\n if (dy4D.rank === 3) {\n
dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () =>
`Error in conv2dDerFilter: input must be rank 4, but got shape ` +\n ` ${x4D.shape}.`);\n util.assert(\n
dy4D.rank === 4,\n () => `Error in conv2dDerFilter: dy must be rank 4, but got shape ` +\n
`${dy4D.shape}.`);\n util.assert(\n filterShape.length === 4,\n () => `Error in conv2dDerFilter: filterShape
must be length 4, but got ` +\n ` ${filterShape}.`);\n const inDepth = dataFormat === 'NHWC' ? x4D.shape[3]
: x4D.shape[1];\n const outDepth = dataFormat === 'NHWC' ? dy4D.shape[3] : dy4D.shape[1];\n util.assert(\n
inDepth === filterShape[2],\n () => `Error in conv2dDerFilter: depth of input ${inDepth}) must ` +\n
`match input depth in filter (${filterShape[2]}).`);\n util.assert(\n outDepth === filterShape[3],\n () => `Error
in conv2dDerFilter: depth of dy (${outDepth}) must ` +\n `match output depth for filter
(${filterShape[3]}).`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n ()
=> `Error in conv2dDerFilter: pad must be an integer when using, ` +\n `dimRoundingMode
${dimRoundingMode} but got pad ${pad}.`);\n }\n\n const inputs: Conv2DBackpropFilterInputs = {x: x4D, dy:
dy4D};\n const attrs: Conv2DBackpropFilterAttrs = {\n strides, pad, dataFormat, dimRoundingMode,
filterShape};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n
Conv2DBackpropFilter, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as
Tensor4D;\n}\n\nexport const conv2DBackpropFilter = op({conv2DBackpropFilter_});\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {Tensor} from './tensor';\n\nimport * as broadcast_util from './broadcast_util';\nimport {elu} from './elu';\nimport {Activation} from './fused_types';\nimport {leakyRelu} from './leaky_relu';\nimport {mul} from './mul';\nimport {prelu} from './prelu';\nimport {relu} from './relu';\nimport {relu6} from './relu6';\nimport {reshape} from './reshape';\nimport {step} from './step';\nimport {sum} from './sum';\n\n// Returns gradient for fused activation.\nexport function getFusedDyActivation(\n  dy: Tensor, y: Tensor, activation: Activation): Tensor {\n  (activation === null || activation === 'linear') {\n    return dy;\n  }\n  if (activation === 'relu') {\n    return mul(dy, step(y));\n  }\n  throw new Error(`Cannot compute gradient for fused activation ${activation}.`);\n}\n\n// Returns gradient for fused bias.\nexport function getFusedBiasGradient(\n  bias: Tensor, dyActivation: Tensor): Tensor {\n  let res = dyActivation;\n  const reduceAxes = broadcast_util.getReductionAxes(bias.shape, dyActivation.shape);\n  if (reduceAxes.length > 0) {\n    res = sum(res, reduceAxes);\n  }\n  return reshape(res, bias.shape);\n}\n\nexport function applyActivation(\n  x: Tensor, activation: Activation, preluActivationWeights?: Tensor,\n  leakyreluAlpha?: number): Tensor {\n  if (activation === 'linear') {\n    return x;\n  } else if (activation === 'relu') {\n    return relu(x);\n  } else if (activation === 'elu') {\n    return elu(x);\n  } else if (activation === 'relu6') {\n    return relu6(x);\n  } else if (activation === 'prelu') {\n    return prelu(x, preluActivationWeights);\n  } else if (activation === 'leakyrelu') {\n    return leakyRelu(x, leakyreluAlpha);\n  }\n  throw new Error(`Unknown fused activation ${activation}.`);\n}\n\n// Whether we should call fused ops.\nexport const shouldFuse = (gradientDepth: number, activation: Activation) => {\n  const gradientMode = gradientDepth > 0;\n  return !gradientMode || activation === 'linear';\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
*\n\nimport {ENGINE} from './../engine';\nimport {customGrad} from './../gradients';\nimport {FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs} from './../kernel_names';\nimport {NamedAttrMap} from './../kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D} from './../tensor';\nimport {GradSaveFunc, NamedTensorMap} from './../tensor_types';\nimport {makeTypesMatch} from './../tensor_util';\nimport {convertToTensor} from './../tensor_util_env';\nimport {TensorLike} from './../types';\nimport * as util from './../util';\nimport {add} from './add';\nimport * as broadcast_util from './broadcast_util';\nimport {conv2d as unfusedConv2d} from './conv2d';\nimport {conv2DBackpropFilter} from './conv2d_backprop_filter';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport * as conv_util from './conv_util';\nimport {Activation} from './fused_types';\nimport {applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D convolution over the input x, optionally fused with adding a\n * bias and applying an activation.\n *\n * @param inputDepth The depth of the input tensor.\n * @param inShape The shape of the input tensor: [batch, height, width, inChannels].\n * @param outputDepth The depth of the output tensor.\n * @param fSize The size of the filter: [filterHeight, filterWidth, inDepth, outDepth].\n * @param pad The type of padding algorithm: 'same' and 'valid'.\n * @param strides The strides of the convolution: [strideHeight, strideWidth].\n * @param bias The bias tensor, of shape [batch, height, width, inChannels].\n * @param filter The filter tensor, of shape [filterHeight, filterWidth, inDepth, outDepth].\n * @param activation The activation function to apply to the output.\n *\n * @returns An object with the following properties:\n * - x: The input tensor, of rank 4 or rank 3, of shape [batch, height, width, inChannels].\n * - filter: The filter tensor, of rank 4, of shape [filterHeight, filterWidth, inDepth, outDepth].\n * - strides: The strides of the convolution: [strideHeight, strideWidth].\n * - pad: The type of padding algorithm: 'same' and 'valid'.\n * - bias: The bias tensor, of shape [batch, height, width, inChannels].\n * - activation: The activation function to apply to the output.\n *\n * For more info, see this guide: https://www.tensorflow.org/api_guides/python/nn#Convolution\n */\n

```

https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat An optional string from: \"NHWC\", \"NCHW\". Defaults to\n * \"NHWC\". Specify the data format of the input and output data. With the\n * default format \"NHWC\", the data is stored in the order of: [batch,\n * height, width, channels]. Only \"NHWC\" is currently supported.\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n * in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single\n * number, then `dilationHeight == dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n * @param bias Tensor to be added to the result.\n * @param activation Name of activation kernel (defaults to `linear`) to be\n * applied\n * after biasAdd.\n * @param preluActivationWeights Tensor of prelu weights to be applied as part\n * of a `prelu` activation, typically the same shape as `x`.\n * @param leakyreluAlpha Optional. Alpha to be applied as part of a `leakyrelu`\n * activation.\n */\nfunction fusedConv2d<T extends Tensor3D|Tensor4D>({\n x,\n filter,\n strides,\n pad,\n dataFormat = 'NHWC',\n dilations = [1, 1],\n dimRoundingMode,\n bias,\n activation = 'linear',\n preluActivationWeights,\n leakyreluAlpha\n}: {\n x: T|TensorLike,\n filter: Tensor4D|TensorLike,\n strides: [number, number]|number,\n pad: 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat?: 'NHWC'|'NCHW',\n dilations?: [number, number]|number,\n dimRoundingMode?: 'floor'|'round'|'ceil',\n bias?: Tensor|TensorLike,\n activation?: Activation,\n preluActivationWeights?: Tensor,\n leakyreluAlpha?: number\n}): T {\n activation = activation || 'linear';\n if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {\n let result = unfusedConv2d(\n x, filter, strides, pad, dataFormat, dilations, dimRoundingMode);\n if (bias != null) {\n result = add(result, bias);\n }\n return applyActivation(\n result, activation, preluActivationWeights, leakyreluAlpha) as T;\n }\n const \$x = convertToTensor(x, 'x', 'conv2d');\n const \$filter = convertToTensor(filter, 'filter', 'conv2d');\n let x4D = \$x as Tensor4D;\n let reshapedTo4D = false;\n if (\$x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape(\$x, [1, \$x.shape[0], \$x.shape[1], \$x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in fused conv2d: input must be rank 4, but got rank ` +\n `\${x4D.rank}.`);\n util.assert(\n \$filter.rank === 4,\n () => `Error in fused conv2d: filter must be rank 4, but got rank ` +\n `\${\$filter.rank}.`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in fused conv2d: pad must be an integer when using, ` +\n `dimRoundingMode \${dimRoundingMode} but got pad \${pad}.`);\n }\n util.assert(\n x4D.shape[3] === \$filter.shape[2],\n () => `Error in conv2d: depth of input (\${x4D.shape[3]}) must match ` +\n `input depth for filter \${\$filter.shape[2]}.`);\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in conv2D: Either strides or dilations must be 1.` +\n `Got strides \${strides} and dilations \${dilations}`);\n util.assert(\n dataFormat === 'NHWC',\n () => `Error in conv2d: got dataFormat of \${\n dataFormat} but only NHWC is currently supported.`);\n const convInfo = conv_util.computeConv2DInfo(\n x4D.shape, \$filter.shape, strides, dilations, pad, dimRoundingMode);\n let \$bias: Tensor;\n if (bias != null) {\n \$bias = convertToTensor(bias, 'bias', 'fused conv2d');\n [\$bias] = makeTypesMatch(\$bias, \$x);\n broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, \$bias.shape);\n }\n let \$preluActivationWeights: Tensor;\n if (preluActivationWeights != null) {\n \$preluActivationWeights = convertToTensor(\n preluActivationWeights, 'prelu weights', 'fused conv2d');\n }\n const grad = (dy: Tensor4D, saved: Tensor[]) => {\n const [\$filter, x4D, y, \$bias] =\n saved as [Tensor4D, Tensor4D, Tensor4D, Tensor];\n const dyActivation = getFusedDyActivation(dy, y, activation) as Tensor4D;\n util.assert(\n conv_util.tupleValuesAreOne(dilations),\n () => `Error in gradient of fused conv2D: ` +\n `dilation rates greater than 1 ` +\n `are not yet supported in gradients. Got dilations \${dilations}`);\n const xDer =\n conv2DBackpropInput(x4D.shape, dyActivation, \$filter, strides, pad);\n const filterDer =\n conv2DBackpropFilter(x4D, dyActivation, \$filter.shape, strides, pad);\n const der: Tensor[] = [xDer, filterDer];\n if (\$bias != null) {\n const biasDer = getFusedBiasGradient(\$bias, dyActivation);\n der.push(biasDer);\n }\n return der;\n };\n const inputs: FusedConv2DInputs = {\n x: x4D,\n filter: \$filter,\n bias: \$bias,\n preluActivationWeights: \$preluActivationWeights\n };\n const attrs: FusedConv2DAttrs = {\n strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n


```

from './reshape';\n\nfunction depthwiseConv2dNativeBackpropInput_<T extends Tensor3D|Tensor4D>(\n  xShape:
[number, number, number, number], dy: T, filter: Tensor4D,\n  strides: [number, number]|number, pad:
'valid'|'same'|number,\n  dilations: [number, number]|number = [1, 1],\n  dimRoundingMode?: 'floor'|'round'|'ceil'):
T {\n  let dy4D = dy as Tensor4D;\n  let reshapedTo4D = false;\n  if (dy.rank === 3) {\n    reshapedTo4D = true;\n    dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n  }\n  const inputs:
DepthwiseConv2dNativeBackpropInputInputs = {dy: dy4D, filter};\n  const attrs:
DepthwiseConv2dNativeBackpropInputAttrs =\n    {strides, pad, dimRoundingMode, dilations, inputShape:
xShape};\n  const res =\n    // tslint:disable-next-line: no-unnecessary-type-assertion\n    ENGINE.runKernel(\n      DepthwiseConv2dNativeBackpropInput, inputs as {} as NamedTensorMap,\n      attrs as {} as
NamedAttrMap) as T;\n  if (reshapedTo4D) {\n    return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
T;\n  }\n  return res;\n}\n\nexport const depthwiseConv2dNativeBackpropInput =\n  op({depthwiseConv2dNativeBackpropInput_});\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from './engine';\nimport {customGrad} from './gradients';\nimport
{FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D}
from './tensor';\nimport {GradSaveFunc, NamedTensorMap} from './tensor_types';\nimport
{makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {add} from './add';\nimport * as
broadcast_util from './broadcast_util';\nimport * as conv_util from './conv_util';\nimport {depthwiseConv2d
as unfusedDepthwiseConv2d} from './depthwise_conv2d';\nimport {depthwiseConv2dNativeBackpropFilter} from
'./depthwise_conv2d_native_backprop_filter';\nimport {depthwiseConv2dNativeBackpropInput} from
'./depthwise_conv2d_native_backprop_input';\nimport {Activation} from './fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op}
from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes depthwise 2D convolution, optionally
fused with adding a\n * bias and applying an activation.\n * Given a 4D `input` array and a `filter` array of
shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]` containing\n * `inChannels` convolutional
filters of depth 1, this op applies a\n * different filter to each input channel (expanding from 1 channel to\n *
`channelMultiplier` channels for each), then concatenates the results\n * together. The output has `inChannels *
channelMultiplier` channels.\n * See\n *
[https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d](\n *
https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d)\n * for more details.\n * @param obj An
object with the following properties:\n * @param x The input tensor, of rank 4 or rank 3, of shape\n * `[batch,
height, width, inChannels]`. If rank 3, batch of 1 is\n * assumed.\n * @param filter The filter tensor, rank 4, of
shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]`. \n * @param strides The strides of the
convolution: `[strideHeight,\n * strideWidth]`. If strides is a single number, then `strideHeight ==\n *
strideWidth`. \n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size
as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if filter is larger\n *
than 1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates:
`[dilationHeight,\n * dilationWidth]`\n * in which we sample input values across the height and width dimensions\n *
in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single\n * number, then `dilationHeight ==

```

dilationWidth`. If it is greater than $\text{pad} + 1$, then all values of `strides` must be 1.

@param dataFormat: An optional string from: `"NHWC"`, `"NCHW"`. Defaults to `"NHWC"`. Specify the data format of the input and output data. With the default format `"NHWC"`, the data is stored in the order of: [batch, height, width, channels]. Only `"NHWC"` is currently supported.

@param dimRoundingMode: A string from: `'ceil'`, `'round'`, `'floor'`. If none is provided, it will default to `truncate`.

@param bias: Tensor to be added to the result.

@param activation: Name of activation kernel (defaults to `'linear'`).

@param preluActivationWeights: Tensor of prelu weights to be applied as part of a `'prelu'` activation, typically the same shape as `x`.

@param leakyreluAlpha: Optional. Alpha to be applied as part of a `'leakyrelu'` activation.

```

function
fusedDepthwiseConv2d_<T extends Tensor3D|Tensor4D>({
  x: T,
  filter: Tensor4D,
  strides: [number, number],
  pad: number,
  dataFormat: 'NHWC'|'NCHW',
  dilations: [number, number],
  dimRoundingMode: 'floor'|'round'|'ceil',
  bias: Tensor|TensorLike,
  activation: Activation,
  preluActivationWeights: Tensor,
  leakyreluAlpha: number
}): T {
  if (
    shouldFuse(ENGINE.state.gradientDepth, activation) === false
  ) {
    let result = unfusedDepthwiseConv2d(
      x, filter, strides, pad, dataFormat, dilations, dimRoundingMode
    );
    if (bias != null) {
      result = add(result, bias);
    }
    return applyActivation(
      result, activation, preluActivationWeights, leakyreluAlpha
    ) as T;
  }
  const $x = convertToTensor(x, 'x', 'depthwiseConv2d');
  const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');
  let $x4D = $x as Tensor4D;
  let reshapedTo4D = false;
  if ($x.rank === 3) {
    reshapedTo4D = true;
    $x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
  }
  util.assert(
    $x4D.rank === 4,
    () => `Error in fused depthwiseConv2d: input must be rank 4, but got ` +
      `rank ${$x4D.rank}.`
  );
  util.assert(
    $filter.rank === 4,
    () => `Error in fused depthwiseConv2d: filter must be rank 4, ` +
      `but got rank ${$filter.rank}.`
  );
  util.assert(
    $x4D.shape[3] === $filter.shape[2],
    () => `Error in fused depthwiseConv2d: number of input channels ` +
      `(${x4D.shape[3]}) must match the inChannels dimension in ` +
      `filter ${$filter.shape[2]}.`
  );
  if (dilations == null) {
    dilations = [1, 1];
  }
  util.assert(
    conv_util.eitherStridesOrDilationsAreOne(strides, dilations),
    () => `Error in fused depthwiseConv2d: Either strides or dilations must ` +
      `be 1. Got strides ${strides} and dilations ${dilations}`
  );
  if (dimRoundingMode != null) {
    util.assert(
      util.isInt(pad as number),
      () => `Error in fused depthwiseConv2d: pad must be an integer when ` +
      `using dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`
    );
  }
  const convInfo = conv_util.computeConv2DInfo(
    $x4D.shape, $filter.shape, strides, dilations, pad, dimRoundingMode,
    true /* depthwise */
  );
  let $bias: Tensor;
  if (bias != null) {
    $bias = convertToTensor(bias, 'bias', 'fused conv2d');
    $bias = makeTypesMatch($bias, $x);
    broadcast_util.assertAndGetBroadcastShape(
      convInfo.outShape, $bias.shape
    );
  }
  let $preluActivationWeights: Tensor;
  if (preluActivationWeights != null) {
    $preluActivationWeights = convertToTensor(
      preluActivationWeights, 'prelu weights', 'fused depthwiseConv2d'
    );
  }
  const grad = (dy: Tensor4D, saved: Tensor[]) => {
    util.assert(
      conv_util.tupleValuesAreOne(dilations),
      () => `Error in gradient of fused depthwiseConv2d: dilation rates ` +
      `greater than 1 are not yet supported. Got dilations ` +
      `${dilations}`
    );
    const [$filter, $x4D, $y, $bias] = saved;
    const dyActivation = getFusedDyActivation(dy, $y, activation) as Tensor4D;
    const $xDer = depthwiseConv2dNativeBackpropInput(
      ($x4D as Tensor4D).shape, dyActivation, $filter as Tensor4D,
      strides, pad, dilations, dimRoundingMode
    );
    const $filterDer = depthwiseConv2dNativeBackpropFilter(
      ($x4D as Tensor4D), dyActivation, ($filter as Tensor4D).shape,
      strides, pad, dilations, dimRoundingMode
    );
    if (bias != null) {
      const $biasDer = getFusedBiasGradient($bias, dyActivation);
      return [$xDer, $filterDer, $biasDer];
    }
    return [$xDer, $filterDer];
  };
  const inputs: FusedDepthwiseConv2DInputs = {
    x: $x4D,
    filter: $filter,
    bias: $bias,
    preluActivationWeights: $preluActivationWeights
  };
  const attrs: FusedDepthwiseConv2DAttrs = {
    strides,
    pad,
    dataFormat,
    dilations,
    dimRoundingMode,
    activation,
    leakyreluAlpha
  };
  // Depending on the the params passed in we will have different number of
  // inputs and thus a a different number of elements in the gradient.
  if (bias == null) {
    const customOp =
      customGrad((x4D: Tensor4D,

```

```

filter: Tensor4D, save: GradSaveFunc) => {\n      // tslint:disable-next-line: no-unnecessary-type-assertion\n
let res: Tensor4D|Tensor3D = ENGINE.runKernel(\n      FusedDepthwiseConv2D, inputs as {} as
NamedTensorMap,\n      attrs as {} as NamedAttrMap);\n\n      save([filter, x4D, res]);\n\n      if
(reshapedTo4D) {\n      // tslint:disable-next-line: no-unnecessary-type-assertion\n      res = reshape(res,
[res.shape[1], res.shape[2], res.shape[3]]) as\n      Tensor3D;\n      }\n\n      return { value: res, gradFunc:
grad};\n  });\n  return customOp(x4D, $filter) as T;\n } else {\n  const customOpWithBias = customGrad(\n
(x4D: Tensor4D, filter: Tensor4D, bias: Tensor, save: GradSaveFunc) => {\n      // tslint:disable-next-line: no-
unnecessary-type-assertion\n      let res: Tensor4D|Tensor3D = ENGINE.runKernel(\n
FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n      attrs as {} as NamedAttrMap);\n\n      save([filter, x4D, res, bias]);\n\n      if (reshapedTo4D) {\n      // tslint:disable-next-line: no-unnecessary-type-
assertion\n      res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n      Tensor3D;\n      }\n\n      return { value: res, gradFunc: grad};\n  });\n\n  return customOpWithBias(x4D, $filter, $bias) as T;\n
}\n}\n\nexport const depthwiseConv2d = op({ fusedDepthwiseConv2d_ });\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport {_FusedMatMul,
_FusedMatMulAttrs, _FusedMatMulInputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor3D} from '../tensor';\nimport {GradSaveFunc, NamedTensorMap}
from '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport {add} from
'../add';\nimport * as broadcast_util from '../broadcast_util';\nimport {Activation} from '../fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from '../fused_util';\nimport {matMul
as unfusedMatMul} from '../mat_mul';\nimport {op} from '../operation';\nimport {reshape} from
'../reshape';\n\n/**\n * Computes the dot product of two matrices with optional activation and bias.\n *
```js\n *
const a = tf.tensor2d([-1, -2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const bias = tf.tensor2d([1, 2],
[1, 2]);\n * \n * tf.fused.matMul({a, b, bias, activation: 'relu'}).print();\n *
```
\n * @param obj An object with the
following properties:\n * - `a` First matrix in dot product operation.\n * - `b` Second matrix in dot product
operation.\n * - `transposeA` If true, `a` is transposed before multiplication.\n * - `transposeB` If true, `b` is
transposed before multiplication.\n * - `bias` Matrix to be added to the result.\n * - `activation` Name of activation
kernel (defaults to `linear`).\n * - `preluActivationWeights` Tensor of prelu weights.\n * - `leakyreluAlpha` Alpha of
leakyrelu.\n */\nfunction fusedMatMul<T extends Tensor>({\n  a,\n  b,\n  transposeA = false,\n  transposeB =
false,\n  bias,\n  activation = 'linear',\n  preluActivationWeights,\n  leakyreluAlpha,\n}: {\n  a: T|TensorLike,\n  b:
T|TensorLike,\n  transposeA?: boolean,\n  transposeB?: boolean,\n  bias?: Tensor|TensorLike,\n  activation?:
Activation,\n  preluActivationWeights?: Tensor,\n  leakyreluAlpha?: number\n}): T {\n  if
(shouldFuse(ENGINE.state.gradientDepth, activation) === false) {\n    let result = unfusedMatMul(a, b,
transposeA, transposeB);\n    if (bias != null) {\n      result = add(result, bias);\n    }\n    return
applyActivation(\n      result, activation, preluActivationWeights, leakyreluAlpha) as\n      T;\n  }\n\n  let
$a = convertToTensor(a, 'a', 'fused matMul');\n  let $b = convertToTensor(b, 'b', 'fused matMul');\n  [$a, $b] =
makeTypesMatch($a, $b);\n\n  const innerShapeA =\n    transposeA ? $a.shape[$a.rank - 2] : $a.shape[$a.rank -
1];\n  const innerShapeB =\n    transposeB ? $b.shape[$b.rank - 1] : $b.shape[$b.rank - 2];\n\n  const
outerShapeA =\n    transposeA ? $a.shape[$a.rank - 1] : $a.shape[$a.rank - 2];\n  const outerShapeB =\n
transposeB ? $b.shape[$b.rank - 2] : $b.shape[$b.rank - 1];\n\n  const outerDimsA = $a.shape.slice(0, -2);\n  const
outerDimsB = $b.shape.slice(0, -2);\n  const batchDimA = util.sizeFromShape(outerDimsA);\n  const batchDimB

```



```
./fused/depthwise_conv2d';\nimport {matMul} from './fused/mat_mul';\nimport {Activation} from
./fused_types';\n\nexport {Activation, conv2d, depthwiseConv2d, matMul};\n", "/*\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {Tensor1D} from '../tensor';\nimport {op} from './operation';\nimport {cosineWindow} from
../signal_ops_util';\n\n/**\n * Generate a hamming window.\n *\n * See:
https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n *\n * ```js\n *
tf.signal.hammingWindow(10).print();\n * ```\n * @param The length of window\n *\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction hammingWindow_(windowLength: number):
Tensor1D {\n  return cosineWindow(windowLength, 0.54, 0.46);\n}\n\nexport const hammingWindow =
op({hammingWindow_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {Tensor1D} from '../tensor';\nimport {op} from './operation';\nimport {cosineWindow} from
../signal_ops_util';\n\n/**\n * Generate a Hann window.\n *\n * See:
https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n *\n * ```js\n *
tf.signal.hannWindow(10).print();\n * ```\n * @param The length of window\n *\n * @doc {heading: 'Operations',
subheading: 'Signal', namespace: 'signal'}\n *\nfunction hannWindow_(windowLength: number): Tensor1D {\n
return cosineWindow(windowLength, 0.5, 0.5);\n}\n\nexport const hannWindow = op({hannWindow_});\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from './concat';\nimport {fill} from
../fill';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {slice} from './slice';\nimport
{tensor2d} from './tensor2d';\n\n/**\n * Expands input into frames of frameLength.\n * Slides a window size with
frameStep.\n *\n * ```js\n * tf.signal.frame([1, 2, 3], 2, 1).print();\n * ```\n * @param signal The input tensor to be
expanded\n * @param frameLength Length of each frame\n * @param frameStep The frame hop size in samples.\n *
@param padEnd Whether to pad the end of signal with padValue.\n * @param padValue An number to use where
the input signal does\n * not exist when padEnd is True.\n *\n * @doc {heading: 'Operations', subheading:
'Signal', namespace: 'signal'}\n *\nfunction frame_(\n  signal: Tensor1D, frameLength: number, frameStep:
number, padEnd = false,\n  padValue = 0): Tensor {\n  let start = 0;\n  const output: Tensor[] = [];\n  while (start +
frameLength <= signal.size) {\n    output.push(slice(signal, start, frameLength));\n    start += frameStep;\n  }\n\n  if
(padEnd) {\n    while (start < signal.size) {\n      const padLen = (start + frameLength) - signal.size;\n      const pad =
concat([\n        slice(signal, start, frameLength - padLen), fill([padLen], padValue)\n      ]);\n      output.push(pad);\n    }\n  }\n}
```



```

boxes: Tensor2D|TensorLike,\n  boxInd: Tensor1D|TensorLike,\n  cropSize: [number, number],\n  method:
'nearest' | 'bilinear',\n  extrapolationValue = 0,\n  ): Tensor4D {\n  const $image =
convertToTensor(image, 'image', 'cropAndResize');\n  const $boxes = convertToTensor(boxes, 'boxes',
'cropAndResize', 'float32');\n  const $boxInd = convertToTensor(boxInd, 'boxInd', 'cropAndResize', 'int32');\n\n
const numBoxes = $boxes.shape[0];\n\n  util.assert(\n    $image.rank === 4,\n    () => `Error in cropAndResize:
image must be rank 4,` +\n    `but got rank ${$image.rank}.`);\n  util.assert(\n    $boxes.rank === 2 &&
$boxes.shape[1] === 4,\n    () => `Error in cropAndResize: boxes must be have size [${numBoxes},4]` +\n
`but had shape ${$boxes.shape}.`);\n  util.assert(\n    $boxInd.rank === 1 && $boxInd.shape[0] === numBoxes,\n
    () => `Error in cropAndResize: boxInd must be have size [${numBoxes}]` +\n    `but had shape
${$boxes.shape}.`);\n  util.assert(\n    cropSize.length === 2,\n    () => `Error in cropAndResize: cropSize must
be of length 2, but got ` +\n    `length ${cropSize.length}.`);\n  util.assert(\n    cropSize[0] >= 1 && cropSize[1]
>= 1,\n    () => `cropSize must be atleast [1,1], but was ${cropSize}`);\n  util.assert(\n    method === 'bilinear' ||
method === 'nearest',\n    () => `method must be bilinear or nearest, but was ${method}`);\n\n  const inputs:\n  CropAndResizeInputs = {image: $image, boxes: $boxes, boxInd: $boxInd};\n  const attrs: CropAndResizeAttrs =
{method, extrapolationValue, cropSize};\n  const res = ENGINE.runKernel(\n    CropAndResize, inputs as {} as
NamedTensorMap,\n    attrs as {} as NamedAttrMap);\n  return res as Tensor4D;\n}\n\nexport const
cropAndResize = op({cropAndResize_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {ENGINE} from '../engine';\nimport {FlipLeftRight, FlipLeftRightInputs} from
'../kernel_names';\nimport {Tensor4D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport * as util from '../util';\nimport {op} from '../operation';\n\n/**\n * Flips the image left to right.
Currently available in the CPU, WebGL, and\n * WASM backends.\n *\n * @param image 4d tensor of shape
[batch, imageHeight, imageWidth, depth]\n *\n * @doc {heading: 'Operations', subheading: 'Images',
namespace: 'image'} *\nfunction flipLeftRight_(image: Tensor4D|TensorLike): Tensor4D {\n  const $image =
convertToTensor(image, 'image', 'flipLeftRight', 'float32');\n\n  util.assert(\n    $image.rank === 4,\n    () => `Error
in flipLeftRight: image must be rank 4,` +\n    `but got rank ${$image.rank}.`);\n\n  const inputs:
FlipLeftRightInputs = {image: $image};\n  const res =\n    ENGINE.runKernel(FlipLeftRight, inputs as {} as
NamedTensorMap, {});\n  return res as Tensor4D;\n}\n\nexport const flipLeftRight =
op({flipLeftRight_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
*\n\nimport {ENGINE} from '../engine';\nimport {RotateWithOffset, RotateWithOffsetAttrs,
RotateWithOffsetInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
{Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}
from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op}
from '../operation';\n\n/**\n * Rotates the input image tensor counter-clockwise with an optional offset\n * center of

```



```

rotation. Currently available in the CPU, WebGL, and WASM backends.\n * \n * @param image 4d tensor of shape
`[batch, imageHeight, imageWidth, depth]`. \n * @param radians The amount of rotation. \n * @param fillValue The
value to fill in the empty space leftover \n * after rotation. Can be either a single grayscale value (0-255), or an \n *
array of three numbers `[red, green, blue]` specifying the red, green, \n * and blue channels. Defaults to `0`
(black). \n * @param center The center of rotation. Can be either a single value (0-1), or \n * an array of two
numbers `[centerX, centerY]`. Defaults to `0.5` (rotates \n * the image around its center). \n * \n * @doc {heading:
'Operations', subheading: 'Images', namespace: 'image'} \n * \n function rotateWithOffset(\n image:
Tensor4D|TensorLike, radians: number, \n fillValue: number|[number, number, number] = 0, \n center:
number|[number, number] = 0.5): Tensor4D {\n const $image = convertToTensor(image, 'image',
'rotateWithOffset', 'float32'); \n \n util.assert(\n $image.rank === 4, \n () => `Error in rotateWithOffset: image
must be rank 4, ` + \n `but got rank ${$image.rank}.`); \n \n const inputs: RotateWithOffsetInputs = {image:
$image}; \n const attrs: RotateWithOffsetAttrs = {radians, fillValue, center}; \n const res = ENGINE.runKernel(\n
RotateWithOffset, inputs as {} as NamedTensorMap, \n attrs as {} as NamedAttrMap); \n return res as
Tensor4D; \n } \n \n export const rotateWithOffset = op({rotateWithOffset_}); \n * \n * @license \n * Copyright
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you may not use this file except in compliance with the License. \n * You may obtain a copy of the License at \n * \n *
http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable law or agreed to in writing,
software \n * distributed under the License is distributed on an `AS IS` BASIS, \n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific language
governing permissions and \n * limitations under the License. \n *
===== \n
* \n \n import {Tensor1D, Tensor2D} from '../tensor'; \n import * as util from '../util'; \n \n function
nonMaxSuppSanityCheck(\n boxes: Tensor2D, scores: Tensor1D, maxOutputSize: number, \n iouThreshold:
number, scoreThreshold: number, softNmsSigma?: number): {\n maxOutputSize: number, \n iouThreshold:
number, \n scoreThreshold: number, \n softNmsSigma: number} {\n if (iouThreshold == null) {\n iouThreshold
= 0.5; \n } \n if (scoreThreshold == null) {\n scoreThreshold = Number.NEGATIVE_INFINITY; \n } \n if
(softNmsSigma == null) {\n softNmsSigma = 0.0; \n } \n \n const numBoxes = boxes.shape[0]; \n maxOutputSize
= Math.min(maxOutputSize, numBoxes); \n \n util.assert(\n 0 <= iouThreshold && iouThreshold <= 1, \n () =>
`iouThreshold must be in [0, 1], but was `${iouThreshold}`); \n util.assert(\n boxes.rank === 2, \n () => `boxes
must be a 2D tensor, but was of rank `${boxes.rank}`); \n util.assert(\n boxes.shape[1] === 4, \n () => \n
`boxes must have 4 columns, but 2nd dimension was ${boxes.shape[1]}`); \n util.assert(scores.rank === 1, () =>
`scores must be a 1D tensor`); \n util.assert(\n scores.shape[0] === numBoxes, \n () => `scores has
incompatible shape with boxes. Expected ${numBoxes}, ` + \n `but was ${scores.shape[0]}`); \n util.assert(\n
0 <= softNmsSigma && softNmsSigma <= 1, \n () => `softNmsSigma must be in [0, 1], but was
`${softNmsSigma}`); \n return {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma}; \n } \n \n export
{nonMaxSuppSanityCheck}; \n * \n * @license \n * Copyright 2020 Google LLC. All Rights Reserved. \n *
Licensed under the Apache License, Version 2.0 (the `License`); \n * you may not use this file except in
compliance with the License. \n * You may obtain a copy of the License at \n * \n *
http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific language
governing permissions and \n * limitations under the License. \n *
===== \n
* \n \n import {ENGINE} from '../engine'; \n import {NonMaxSuppressionV3} from '../kernel_names'; \n import
{Tensor1D, Tensor2D} from '../tensor'; \n import {convertToTensor} from '../tensor_util_env'; \n import
{TensorLike} from '../types'; \n \n import {nonMaxSuppSanityCheck} from './nonmax_util'; \n import {op} from
 './operation'; \n \n * \n * Performs non maximum suppression of bounding boxes based on \n * iou (intersection over
union). \n * \n * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is \n * `[y1, x1, y2, x2]`, where

```

```

(y1, x1)` and `(y2, x2)` are the corners of the bounding box.
@param scores a 1d tensor providing the box scores of shape [numBoxes].
@param maxOutputSize The maximum number of boxes to be selected.
@param iouThreshold A float representing the threshold for deciding whether boxes overlap too much with respect to IOU. Must be between [0, 1]. Defaults to 0.5 (50% box overlap).
@param scoreThreshold A threshold for deciding when to remove boxes based on score. Defaults to -inf, which means any score is accepted.
@return A 1D tensor with the selected box indices.
@doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
function nonMaxSuppression_(boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
    maxOutputSize: number, iouThreshold = 0.5, scoreThreshold =
    Number.NEGATIVE_INFINITY): Tensor1D {
    const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');
    const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');

    const inputs = nonMaxSupSanityCheck($boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);
    maxOutputSize = inputs.maxOutputSize;
    iouThreshold = inputs.iouThreshold;
    scoreThreshold = inputs.scoreThreshold;

    const attrs = {maxOutputSize, iouThreshold, scoreThreshold};
    return ENGINE.runKernel(NonMaxSuppressionV3, {boxes: $boxes, scores: $scores}, attrs);
}

export const nonMaxSuppression = op({nonMaxSuppression_});

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```

```

=====
/**
 * Inserts a value into a sorted array. This method allows duplicate, meaning it allows inserting
 * duplicate value, in which case, the element will be inserted at the lowest index of the value.
 * @param arr The array to modify.
 * @param element The element to insert.
 * @param comparator Optional. If no comparator is specified, elements are compared using
 * array_util.defaultComparator, which is suitable for Strings and Numbers in ascending arrays.
 * If the array contains multiple instances of the target value, the left-most instance will be
 * returned. To provide a comparator, it should take 2 arguments to compare and return a negative,
 * zero, or a positive number.
 * @export function binaryInsert<T>(arr: T[], element: T, comparator?: (a: T, b: T) => number) {
 *   const index = binarySearch(arr, element, comparator);
 *   const insertionPoint = index < 0 ? -(index + 1) : index;
 *   arr.splice(insertionPoint, 0, element);
 * }
 * Searches the array for the target using binary search, returns the index of the found element,
 * or position to insert if element not found. If no comparator is specified, elements are
 * compared using array_util.defaultComparator, which is suitable for Strings and Numbers in
 * ascending arrays. If the array contains multiple instances of the target value, the left-most
 * instance will be returned.
 * @param arr The array to be searched in.
 * @param target The target to be searched for.
 * @param comparator Should take 2 arguments to compare and return a negative, zero, or a
 * positive number.
 * @return Lowest index of the target value if found, otherwise the insertion point where the
 * target should be inserted, in the form of -(insertionPoint - 1).
 * @export function binarySearch<T>(arr: T[], target: T, comparator?: (a: T, b: T) => number) {
 *   return binarySearch_(arr, target, comparator || defaultComparator);
 * }
 * Compares its two arguments for order.
 * @param a The first element to be compared.
 * @param b The second element to be compared.
 * @return A negative number, zero, or a positive number as the first argument is less than,
 * equal to, or greater than the second.
 * @function defaultComparator<T>(a: T, b: T): number {
 *   return a > b ? 1 : a < b ? -1 : 0;
 * }
 * @function binarySearch_<T>(arr: T[], target: T, comparator: (a: T, b: T) => number) {
 *   let left = 0;
 *   let right = arr.length;
 *   let middle = 0;
 *   let found = false;
 *   while (left < right) {
 *     middle = left + ((right - left) >>> 1);
 *     const compareResult = comparator(target, arr[middle]);
 *     if (compareResult > 0) {
 *       left = middle + 1;
 *     } else {
 *       right = middle;
 *       // If compareResult is 0, the value is found. We record it is found,
 *       // and then keep looking because there may be duplicate.
 *       found = !compareResult;
 *     }
 *   }
 *   return found ? left : -left - 1;
 * }
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```

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```
=====\n*\n\nimport {TypedArray} from '../types';\nimport {binaryInsert} from './non_max_suppression_util';\n\n\nImplementation of the NonMaxSuppression kernel shared between webgl and cpu.\n\ninterface Candidate {\n  score: number;\n  boxIndex: number;\n  suppressBeginIndex: number;\n}\n\ninterface NonMaxSuppressionResult {\n  selectedIndices: number[];\n  selectedScores?: number[];\n  validOutputs?: number;\n}\n\nexport function\nnonMaxSuppressionV3Impl(\n  boxes: TypedArray, scores: TypedArray, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number): NonMaxSuppressionResult {\n  return\nnonMaxSuppressionImpl_(\n    boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,\n    0 /*\nsoftNmsSigma */);\n}\n\nexport function nonMaxSuppressionV4Impl(\n  boxes: TypedArray, scores: TypedArray,\n  maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  padToMaxOutputSize: boolean):\nNonMaxSuppressionResult {\n  return nonMaxSuppressionImpl_(\n    boxes, scores, maxOutputSize,\n    iouThreshold, scoreThreshold,\n    0 /* softNmsSigma */, false /* returnScoresTensor */,\n    padToMaxOutputSize /* padToMaxOutputSize */, true\n    /* returnValidOutputs */);\n}\n\nexport function\nnonMaxSuppressionV5Impl(\n  boxes: TypedArray, scores: TypedArray, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  softNmsSigma: number): NonMaxSuppressionResult {\n  return nonMaxSuppressionImpl_(\n    boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma,\n    true /* returnScoresTensor */);\n}\n\nfunction nonMaxSuppressionImpl_(\n  boxes:\nTypedArray, scores: TypedArray, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  softNmsSigma: number,\n  returnScoresTensor = false, padToMaxOutputSize = false,\n  returnValidOutputs =\nfalse): NonMaxSuppressionResult {\n  // The list is sorted in ascending order, so that we can always pop the\n  // candidate with the largest score in O(1) time.\n  const candidates = [];\n  for (let i = 0; i < scores.length; i++) {\n    if (scores[i] > scoreThreshold) {\n      candidates.push({score: scores[i], boxIndex: i, suppressBeginIndex: 0});\n    }\n  }\n  candidates.sort(ascendingComparator);\n  // If softNmsSigma is 0, the outcome of this algorithm is\n  // exactly same as\n  // before.\n  const scale = softNmsSigma > 0 ? (-0.5 / softNmsSigma) : 0.0;\n  const\nselectedIndices: number[] = [];\n  const selectedScores: number[] = [];\n  while (selectedIndices.length <\nmaxOutputSize && candidates.length > 0) {\n    const candidate = candidates.pop();\n    const {score: originalScore,\nboxIndex, suppressBeginIndex} = candidate;\n    if (originalScore < scoreThreshold) {\n      break;\n    }\n    //\nOverlapping boxes are likely to have similar scores, therefore we\n    // iterate through the previously selected boxes\n    // backwards in order to\n    // see if candidate's score should be suppressed. We use\n    // suppressBeginIndex to track\n    // and ensure a candidate can be suppressed\n    // by a selected box no more than once. Also, if the overlap exceeds\n    // iouThreshold, we simply ignore the candidate.\n    let ignoreCandidate = false;\n    for (let j =\nselectedIndices.length - 1; j >= suppressBeginIndex; --j) {\n      const iou = intersectionOverUnion(boxes, boxIndex,\nselectedIndices[j]);\n      if (iou >= iouThreshold) {\n        ignoreCandidate = true;\n        break;\n      }\n      candidate.score =\n        candidate.score * suppressWeight(iouThreshold, scale, iou);\n      if (candidate.score <=\nscoreThreshold) {\n        break;\n      }\n    }\n    // At this point, if `candidate.score` has not dropped below\n    // `scoreThreshold`, then we know that we went through all of the\n    // previous selections and can safely update\n    // `suppressBeginIndex` to the\n    // end of the selected array. Then we can re-insert the candidate with\n    // the\n    // updated score and suppressBeginIndex back in the candidate list.\n    // If on the other hand, `candidate.score` has\n    // dropped below the score\n    // threshold, we will not add it back to the candidates list.\n    candidate.suppressBeginIndex = selectedIndices.length;\n    if (!ignoreCandidate) {\n      // Candidate has passed\n      // all the tests, and is not suppressed, so\n      // select the candidate.\n      if (candidate.score === originalScore) {\n        selectedIndices.push(boxIndex);\n        selectedScores.push(candidate.score);\n      } else if (candidate.score >
```



```

maxOutputSize: number, iouThreshold = 0.5,\n  scoreThreshold = Number.NEGATIVE_INFINITY):
Promise<Tensor1D> {\n  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n  const
$scores = convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n\n  const inputs =
nonMaxSuppSanityCheck(\n    $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n  maxOutputSize
= inputs.maxOutputSize;\n  iouThreshold = inputs.iouThreshold;\n  scoreThreshold = inputs.scoreThreshold;\n\n
const boxesAndScores = await Promise.all([$boxes.data(), $scores.data()]);\n  const boxesVals =
boxesAndScores[0];\n  const scoresVals = boxesAndScores[1];\n\n  // We call a cpu based impl directly with the
typedarray data here rather\n  // than a kernel because all kernels are synchronous (and thus cannot await\n  //
.data()).\n  const {selectedIndices} = nonMaxSuppressionV3Impl(\n    boxesVals, scoresVals, maxOutputSize,
iouThreshold, scoreThreshold);\n  if ($boxes !== boxes) {\n    $boxes.dispose();\n  }\n  if ($scores !== scores) {\n
$scores.dispose();\n  }\n\n  return tensor1d(selectedIndices, 'int32');\n}\n\nexport const nonMaxSuppressionAsync =
nonMaxSuppressionAsync_;\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor1D, Tensor2D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\n\nimport {nonMaxSuppSanityCheck} from './nonmax_util';\nimport {op} from './operation';\n\n**\n
* Performs non maximum suppression of bounding boxes based on\n * iou (intersection over union).\n * This op
also supports a Soft-NMS mode (c.f.\n * Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the
score\n * of other overlapping boxes, therefore favoring different regions of the image\n * with high scores. To
enable this Soft-NMS mode, set the `softNmsSigma`\n * parameter to be larger than 0.\n * @param boxes a 2d
tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the
corners of\n * the bounding box.\n * @param scores a 1d tensor providing the box scores of shape
`[numBoxes]`\n * @param maxOutputSize The maximum number of boxes to be selected.\n * @param
iouThreshold A float representing the threshold for deciding whether\n * boxes overlap too much with respect to
IOU. Must be between [0, 1].\n * Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for
deciding when to remove boxes based\n * on score. Defaults to -inf, which means any score is accepted.\n *
@param softNmsSigma A float representing the sigma parameter for Soft NMS.\n * When sigma is 0, it falls
back to nonMaxSuppression.\n * @return A map with the following properties:\n * - selectedIndices: A 1D tensor
with the selected box indices.\n * - selectedScores: A 1D tensor with the corresponding scores for each\n *
selected box.\n *\n * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\nfunction
nonMaxSuppressionWithScore_ (\n  boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n  maxOutputSize: number, iouThreshold = 0.5,\n  scoreThreshold = Number.NEGATIVE_INFINITY,\n  softNmsSigma = 0.0): NamedTensorMap {\n  const $boxes = convertToTensor(boxes, 'boxes',
'nonMaxSuppression');\n  const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');\n\n  const
params = nonMaxSuppSanityCheck(\n    $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n  maxOutputSize = params.maxOutputSize;\n  iouThreshold = params.iouThreshold;\n
scoreThreshold = params.scoreThreshold;\n  softNmsSigma = params.softNmsSigma;\n\n  const inputs:
NonMaxSuppressionV5Inputs = {boxes: $boxes, scores: $scores};\n  const attrs: NonMaxSuppressionV5Attrs =\n  {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma};\n\n  // tslint:disable-next-line: no-unnecessary-
type-assertion\n  const result = ENGINE.runKernel(\n    NonMaxSuppressionV5, inputs as {} as

```

```

NamedTensorMap,\n          attrs as { } as NamedAttrMap) as Tensor[];\n\n return { selectedIndices: result[0],\n        selectedScores: result[1]};\n\n\nexport const nonMaxSuppressionWithScore =\n  op({nonMaxSuppressionWithScore_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\nimport {nonMaxSuppressionV5Impl} from '../backends/non_max_suppression_impl';\nimport {Tensor1D,\n        Tensor2D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}\n        from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {nonMaxSuppSanityCheck} from\n        './nonmax_util';\nimport {tensor1d} from './tensor1d';\n\n/**\n * Asynchronously performs non maximum\n * suppression of bounding boxes based on\n * iou (intersection over union).\n * This op also supports a Soft-NMS\n * mode (c.f. Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the score\n * of other overlapping\n * boxes, therefore favoring different regions of the image\n * with high scores. To enable this Soft-NMS mode, set the\n * `softNmsSigma`\n * parameter to be larger than 0.\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`.\n * Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param maxSize The\n * maximum number of boxes to be selected.\n * @param iouThreshold A float representing the threshold for deciding\n * whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n * Defaults to 0.5 (50% box\n * overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes based\n * on score.\n * Defaults to -inf, which means any score is accepted.\n * @param softNmsSigma A float representing the sigma\n * parameter for Soft NMS.\n * When sigma is 0, it falls back to nonMaxSuppression.\n * @return A map with the\n * following properties:\n * - selectedIndices: A 1D tensor with the selected box indices.\n * - selectedScores: A\n * 1D tensor with the corresponding scores for each\n * selected box.\n *\n * @doc {heading: 'Operations',\n *       subheading: 'Images',\n *       namespace: 'image'}\n *\n ^\nasync function nonMaxSuppressionWithScoreAsync(\n        boxes:\n        Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n        maxSize: number, iouThreshold = 0.5,\n        scoreThreshold = Number.NEGATIVE_INFINITY,\n        softNmsSigma = 0.0): Promise<NamedTensorMap> {\n  const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n  const $scores =\n    convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n\n  const params = nonMaxSuppSanityCheck(\n    $boxes, $scores, maxSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n  maxSize =\n    params.maxOutputSize;\n  iouThreshold = params.iouThreshold;\n  scoreThreshold =\n    params.scoreThreshold;\n  softNmsSigma =\n    params.softNmsSigma;\n\n  const boxesAndScores = await Promise.all([$boxes.data(),\n    $scores.data()]);\n  const boxesVals = boxesAndScores[0];\n  const scoresVals =\n    boxesAndScores[1];\n\n  // We call\n  a cpu based impl directly with the typedarray data here rather\n  // than a kernel because all kernels are synchronous\n  (and thus cannot await\n  // .data()).\n  const {selectedIndices, selectedScores} = nonMaxSuppressionV5Impl(\n    boxesVals, scoresVals, maxSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n\n  if ($boxes !==\n    boxes) {\n    $boxes.dispose();\n  }\n  if ($scores !==\n    scores) {\n    $scores.dispose();\n  }\n\n  return {\n    selectedIndices: tensor1d(selectedIndices, 'int32'),\n    selectedScores: tensor1d(selectedScores)\n  };}\n\n\nexport\n  const nonMaxSuppressionWithScoreAsync = nonMaxSuppressionWithScoreAsync;\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n *

```

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=====
*\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor1D, Tensor2D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\n\nimport {nonMaxSuppSanityCheck} from './nonmax_util';\nimport {op} from './operation';\n\n/**
 * Asynchronously performs non maximum suppression of bounding boxes based on
 * iou (intersection over union), with an option to pad results.
 * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is
 * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of
 * the bounding box.
 * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.
 * @param maxOutputSize The maximum number of boxes to be selected.
 * @param iouThreshold A float representing the threshold for deciding whether
 * boxes overlap too much with respect to IOU. Must be between [0, 1].
 * Defaults to 0.5 (50% box overlap).
 * @param scoreThreshold A threshold for deciding when to remove boxes based
 * on score. Defaults to -inf, which means any score is accepted.
 * @param padToMaxOutputSize Defaults to false. If true, size of output
 * `selectedIndices` is padded to maxOutputSize.
 * @return A map with the following properties:
 * - selectedIndices: A 1D tensor with the selected box indices.
 * - validOutputs: A scalar denoting how many elements in `selectedIndices`
 * are valid. Valid elements occur first, then padding.
 * @doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
 */
function nonMaxSuppressionPadded_(\n boxes:
Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize: number, iouThreshold = 0.5,\n
scoreThreshold = Number.NEGATIVE_INFINITY,\n padToMaxOutputSize = false): NamedTensorMap {\n
const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n const $scores = convertToTensor(scores,
'scores', 'nonMaxSuppression');\n\n const params = nonMaxSuppSanityCheck(\n $boxes, $scores,
maxOutputSize, iouThreshold, scoreThreshold,\n null /* softNmsSigma */);\n const $maxOutputSize =
params.maxOutputSize;\n const $iouThreshold = params.iouThreshold;\n const $scoreThreshold =
params.scoreThreshold;\n\n const inputs: NonMaxSuppressionV4Inputs = {boxes: $boxes, scores: $scores};\n
const attrs: NonMaxSuppressionV4Attrs = {\n maxOutputSize: $maxOutputSize,\n iouThreshold:
$iouThreshold,\n scoreThreshold: $scoreThreshold,\n padToMaxOutputSize\n };\n\n // tslint:disable-next-line:
no-unnecessary-type-assertion\n const result = ENGINE.runKernel(\n NonMaxSuppressionV4, inputs
as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor[];\n\n return {selectedIndices:
result[0], validOutputs: result[1]};\n}\n\nexport const nonMaxSuppressionPadded =
op({nonMaxSuppressionPadded_};\n\n/**
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 * limitations under the License.
 */
=====

```

```

*\n\nimport {nonMaxSuppressionV4Impl} from '../backends/non_max_suppression_impl';\nimport {Tensor1D,
Tensor2D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}
from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {nonMaxSuppSanityCheck} from
'./nonmax_util';\nimport {scalar} from './scalar';\nimport {tensor1d} from './tensor1d';\n\n/**
 * Asynchronously performs non maximum suppression of bounding boxes based on
 * iou (intersection over union), with an option to pad results.
 * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is
 * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of
 * the bounding box.
 * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.
 * @param maxOutputSize The maximum number of boxes to be selected.
 * @param iouThreshold A float representing the threshold for deciding whether
 * boxes overlap too much with respect to IOU. Must be between [0, 1].
 * Defaults to 0.5 (50% box overlap).
 * @param

```


must be greater than or equal to the number of vectors.
 @returns The orthogonalized and normalized vectors or matrix.
 Orthogonalization means that the vectors or the rows of the matrix are orthogonal (zero inner products). Normalization means that each vector or each row of the matrix has an L2 norm that equals 1.
 @doc {heading:'Operations', subheading:'Linear Algebra', namespace:'linalg'}
 ^/nfunction gramSchmidt_(xs: Tensor1D[]|Tensor2D): Tensor1D[]|Tensor2D {
 let inputIsTensor2D: boolean;
 if (Array.isArray(xs)) {
 inputIsTensor2D = false;
 assert(xs != null && xs.length > 0, () => 'Gram-Schmidt process: input must not be null, undefined, or ' + 'empty');
 const dim = xs[0].shape[0];
 for (let i = 1; i < xs.length; ++i) {
 assert(xs[i].shape[0] === dim, () => 'Gram-Schmidt: Non-unique lengths found in the input vectors: ' + `(\${xs as Tensor1D[]}[i].shape[0] vs. \${dim})`);
 }
 } else {
 inputIsTensor2D = true;
 xs = split(xs, xs.shape[0], 0).map(x => squeeze(x, [0]));
 }
 assert(xs.length <= xs[0].shape[0], () => `Gram-Schmidt: Number of vectors (\${xs as Tensor1D[]}.length) exceeds ` + `number of dimensions (\${xs as Tensor1D[]}[0].shape[0]).`);
 const ys: Tensor1D[] = [];
 const xs1d = xs;
 for (let i = 0; i < xs.length; ++i) {
 ys.push(ENGINE.tidy(() => {
 let x = xs1d[i];
 if (i > 0) {
 for (let j = 0; j < i; ++j) {
 const proj = mul(sum(mul(ys[j], x)), ys[j]);
 x = sub(x, proj);
 }
 }
 return div(x, norm(x, 'euclidean'));
 }));
 }
 if (inputIsTensor2D) {
 return stack(ys, 0) as Tensor2D;
 } else {
 return ys;
 }
 }
 }
 export const gramSchmidt = op({gramSchmidt_});
 "/*
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 */

```

=====
import {ENGINE} from '../engine';
import {dispose} from '../globals';
import {Tensor, Tensor2D} from '../tensor';
import {assert} from '../util';
import {clone} from './clone';
import {concat} from './concat';
import {div} from './div';
import {eye} from './eye';
import {greater} from './greater';
import {matMul} from './mat_mul';
import {mul} from './mul';
import {neg} from './neg';
import {norm} from './norm';
import {op} from './operation';
import {reshape} from './reshape';
import {slice} from './slice';
import {stack} from './stack';
import {sub} from './sub';
import {tensor2d} from './tensor2d';
import {transpose} from './transpose';
import {unstack} from './unstack';
import {where} from './where';
*/
Compute QR decomposition of m-by-n matrix using Householder transformation.
Implementation based on [http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf]
(http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf)
const a = tf.tensor2d([[1, 2], [3, 4]]);
let [q, r] = tf.linalg.qr(a);
console.log('Q');
q.print();
console.log('R');
r.print();
console.log('Orthogonalized');
q.dot(q.transpose()).print() // should be nearly the identity matrix.
console.log('Reconstructed');
q.dot(r).print(); // should be nearly [[1, 2], [3, 4]]
*/
@param x The `tf.Tensor` to be QR-decomposed. Must have rank >= 2. Suppose it has the shape `[..., M, N]`
@param fullMatrices An optional boolean parameter. Defaults to `false`
  If `true`, compute full-sized `Q`. If `false` (the default), compute only the leading N columns of `Q` and `R`
@returns An `Array` of two `tf.Tensor`s: `[Q, R]`
  `Q` is a unitary matrix, i.e., its columns all have unit norm and are mutually orthogonal
  If `M >= N`,
  If `fullMatrices` is `false` (default),
    - `Q` has a shape of `[..., M, N]`
    - `R` has a shape of `[..., N, N]`
  If `fullMatrices` is `true` (default),
    - `Q` has a shape of `[..., M, M]`
    - `R` has a shape of `[..., M, N]`
  If `M < N`,
    - `Q` has a shape of `[..., M, M]`
    - `R` has a shape of `[..., M, N]`
@throws If the rank of `x` is less than 2.
@doc {heading:'Operations', subheading:'Linear Algebra', namespace:'linalg'}
^/nfunction qr_(x: Tensor, fullMatrices = false): [Tensor, Tensor] {
assert(x.rank >= 2, () => `qr() requires input tensor to have a rank >= 2, but got rank ${x.rank}`);
if (x.rank === 2) {
return qr2d(x as Tensor2D, fullMatrices);
} else {
// Rank > 2. //

```

```

TODO(cais): Below we split the input into individual 2D tensors,
// perform QR decomposition on them and
then stack the results back
// together. We should explore whether this can be parallelized.
const
outerDimsProd = x.shape.slice(0, x.shape.length - 2)
.reduce((value, prev) => value * prev);
const x2ds = unstack(
  reshape(
    x,
    [
      outerDimsProd, x.shape[x.shape.length - 2],
      x.shape[x.shape.length - 1]
    ],
    0);
const q2ds: Tensor2D[] = [];
const r2ds: Tensor2D[] = [];
x2ds.forEach(x2d => {
  const [q2d, r2d] = qr2d(x2d as Tensor2D, fullMatrices);
q2ds.push(q2d);
r2ds.push(r2d);
});
const q = reshape(stack(q2ds, 0), x.shape);
const r = reshape(stack(r2ds, 0), x.shape);
return [q, r];
})
function qr2d(x: Tensor2D, fullMatrices = false):
[Tensor2D, Tensor2D] {
return ENGINE.tidy(() => {
assert(
  x.shape.length === 2,
  () => `qr2d()
requires a 2D Tensor, but got a ${
  x.shape.length}D Tensor.`);
const m = x.shape[0];
const n = x.shape[1];
let q = eye(m); // Orthogonal transform so far.
let r = clone(x); // Transformed matrix so far.
const one2D = tensor2d([[1]], [1, 1]);
let w: Tensor2D = clone(one2D);
const iters = m >= n ? n : m;
for (let j = 0; j < iters; ++j) {
// This tidy within the for-loop ensures we clean up temporary
// tensors as soon as they are no longer needed.
const rTemp = r;
const wTemp = w;
const qTemp = q;
[w, r, q] = ENGINE.tidy(): [Tensor2D, Tensor2D, Tensor2D] => {
// Find H = I - tau * w * w', to put zeros
below R(j, j).
const rjEnd1 = slice(r, [j, j], [m - j, 1]);
const normX = norm(rjEnd1);
const rjj = slice(r, [j, j], [1, 1]);
// The sign() function returns 0 on 0, which causes division by zero.
const s = where(greater(rjj, 0), tensor2d([[1]]), tensor2d([[1]]));
const u1 = sub(rjj, mul(s, normX));
const wPre = div(rjEnd1, u1);
if (wPre.shape[0] === 1) {
w = clone(one2D);
} else {
w = concat(
  [
    one2D,
    slice(wPre, [1, 0], [wPre.shape[0] - 1, wPre.shape[1]])
  ] as
Tensor2D,
  0);
}
const tau = neg(div(matMul(s, u1), normX)) as Tensor2D;
// -- R := HR, Q := QH.
const rjEndAll = slice(r, [j, 0], [m - j, n]);
const tauTimesW: Tensor2D = mul(tau, w);
const wT: Tensor2D = transpose(w);
if (j === 0) {
r = sub(rjEndAll, matMul(tauTimesW, matMul(wT, rjEndAll)));
} else {
const rTimesTau: Tensor2D = sub(rjEndAll, matMul(tauTimesW, matMul(wT, rjEndAll)));
r = concat([slice(r, [0, 0], [j, n]), rTimesTau], 0);
}
const tauTimesWT: Tensor2D = transpose(tauTimesW);
const qAllJEnd = slice(q, [0, j], [m, q.shape[1] - j]);
if (j === 0) {
q = sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT));
} else {
const qTimesTau: Tensor2D = sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT));
q = concat([slice(q, [0, 0], [m, j]), qTimesTau, 1);
}
return [w, r, q];
});
dispose([rTemp, wTemp, qTemp]);
}
if (!fullMatrices && m > n) {
q = slice(q, [0, 0], [m, n]);
r = slice(r, [0, 0], [n, n]);
}
return [q, r];
}) as [Tensor2D, Tensor2D];
}
export const qr =
op({qr_});
"/**
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*/
=====
*/
export enum Reduction {
NONE,
MEAN,
SUM,
SUM_BY_NONZERO_WEIGHTS
}
"/**
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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* limitations under the License.
*/
=====
*/
import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import

```


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```
=====\n*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from '../loss_ops_utils';\nimport {mul} from '../mul';\nimport {op} from '../operation';\nimport {scalar} from '../scalar';\nimport {sub} from '../sub';\nimport {sum} from '../sum';\n\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes the cosine distance loss between two tensors.\n * @param labels The ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n * @param axis The dimension along which the cosine distance is computed.\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n */\nfunction cosineDistance<T extends Tensor, O extends Tensor>(\n  labels: T|TensorLike, predictions: T|TensorLike, axis: number,\n  weights?: Tensor|TensorLike, reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n  const $labels = convertToTensor(labels, 'labels', 'cosineDistance');\n  const $predictions = convertToTensor(predictions, 'predictions', 'cosineDistance');\n  let $weights: Tensor = null;\n  if (weights != null) {\n    $weights = convertToTensor(weights, 'weights', 'cosineDistance');\n  }\n  assertShapesMatch($labels.shape, $predictions.shape, 'Error in cosineDistance: ');\n  const one = scalar(1);\n  const losses = sub(one, sum(mul($labels, $predictions), axis, true));\n  return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const cosineDistance = op({cosineDistance});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from '../loss_ops_utils';\nimport {mul} from '../mul';\nimport {op} from '../operation';\nimport {relu} from '../relu';\nimport {scalar} from '../scalar';\nimport {sub} from '../sub';\n\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes the Hinge loss between two tensors.\n * @param labels The ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n */\nfunction hingeLoss<T extends Tensor, O extends Tensor>(\n  labels: T|TensorLike, predictions: T|TensorLike, weights?: Tensor|TensorLike,\n  reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n  let $labels = convertToTensor(labels, 'labels', 'hingeLoss');\n  const $predictions = convertToTensor(predictions, 'predictions', 'hingeLoss');\n  let $weights: Tensor = null;\n  if (weights != null) {\n    $weights = convertToTensor(weights, 'weights', 'hingeLoss');\n  }\n  assertShapesMatch($labels.shape, $predictions.shape, 'Error in hingeLoss: ');\n  const one = scalar(1);\n  // Convert binary labels to (-1, 1)\n  $labels = sub(mul(scalar(2), $labels), one);\n  const losses = relu(sub(one, mul($labels, $predictions)));\n  return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const hingeLoss = op({hingeLoss});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n */\n
```

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=====
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport\n{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from './abs';\nimport\n{add} from './add';\nimport {Reduction} from './loss_ops_utils';\nimport {minimum} from './minimum';\nimport\n{mul} from './mul';\nimport {op} from './operation';\nimport {scalar} from './scalar';\nimport {square} from\n './square';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from\n './compute_weighted_loss';\n\n/**\n * Computes the huber loss between two tensors.\n * @param labels The\n ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to\n `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param delta Point where huber loss changes from quadratic to linear.\n * @param reduction Type of reduction to\n apply to loss. Should be of type\n * `Reduction`.\n * @doc {heading: 'Training', subheading: 'Losses',\n namespace: 'losses'}\n */\nfunction huberLoss_<T extends Tensor, O extends Tensor>(\n  labels: T|TensorLike,\n  predictions: T|TensorLike,\n  weights?: Tensor|TensorLike, delta = 1.0,\n  reduction =\n  Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n  const $labels = convertToTensor(labels, 'labels',\n 'huberLoss');\n  const $predictions = convertToTensor(predictions, 'predictions', 'huberLoss');\n  let $weights:\n  Tensor = null;\n  if (weights != null) {\n    $weights = convertToTensor(weights, 'weights', 'huberLoss');\n  }\n  assertShapesMatch($labels.shape, $predictions.shape, 'Error in huberLoss: ');\n  const deltaScalar =\n  scalar(delta);\n  const error = abs(sub($predictions, $labels));\n  const quadratic = minimum(error, deltaScalar);\n  const linear = sub(error, quadratic);\n  const losses =\n    add(mul(scalar(0.5), square(quadratic)),\n    mul(deltaScalar, linear));\n  return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const huberLoss\n = op({huberLoss_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */\n
```

```
=====
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport\n{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {add} from './add';\nimport\n{log} from './log';\nimport {Reduction} from './loss_ops_utils';\nimport {mul} from './mul';\nimport {neg} from\n './neg';\nimport {op} from './operation';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\nimport\n{computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes the log loss between two tensors.\n * @param labels The ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and\n must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding\n `losses`\n * dimension).\n * @param epsilon A small increment to avoid taking log of zero\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`.\n * @doc {heading: 'Training',\n subheading: 'Losses', namespace: 'losses'}\n */\nfunction logLoss_<T extends Tensor, O extends Tensor>(\n  labels: T|TensorLike, predictions: T|TensorLike,\n  weights?: Tensor|TensorLike, epsilon = 1e-7,\n  reduction =\n  Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n  const $labels = convertToTensor(labels, 'labels', 'logLoss');\n
```

```

const $predictions = convertToTensor(predictions, 'predictions', 'logLoss');
let $weights: Tensor = null;
if (weights != null) {
  $weights = convertToTensor(weights, 'weights', 'logLoss');
}
assertShapesMatch($labels.shape, $predictions.shape, 'Error in logLoss: ');
const one = scalar(1);
const epsilonScalar = scalar(epsilon);
const l1 = neg(mul($labels, log(add($predictions, epsilonScalar)));
const l2 =
  mul(sub(one, $labels), log(add(sub(one, $predictions), epsilonScalar)));
const losses = sub(l1, l2);
return computeWeightedLoss(losses, $weights, reduction);
}
export const logLoss = op({logLoss_});

```

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```

=====
*/
import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assertShapesMatch} from '../util';
import {Reduction} from
  '../loss_ops_utils';
import {op} from '../operation';
import {squaredDifference} from
  '../squared_difference';
import {computeWeightedLoss} from './compute_weighted_loss';
/**
 * Computes the mean squared error between two tensors.
 * @param labels The ground truth output tensor, same dimensions as
 * `predictions`.
 * @param predictions The predicted outputs.
 * @param weights Tensor whose rank is either 0, or the same rank as
 * `labels`, and must be broadcastable to `labels` (i.e., all dimensions
 * must be either `1`, or the same as the corresponding `losses`
 * dimension).
 * @param reduction Type of reduction to apply to loss. Should be of type
 * `Reduction`
 * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}
 */
function meanSquaredError<T extends Tensor, O extends Tensor>(
  labels: T|TensorLike,
  predictions: T|TensorLike,
  weights?: Tensor|TensorLike,
  reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  const $labels = convertToTensor(labels, 'labels', 'meanSquaredError');
  const $predictions =
    convertToTensor(predictions, 'predictions', 'meanSquaredError');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights =
      convertToTensor(weights, 'weights', 'meanSquaredError');
  }
  assertShapesMatch($labels.shape, $predictions.shape, 'Error in meanSquaredError: ');
  const losses = squaredDifference($labels, $predictions);
  return computeWeightedLoss(losses, $weights, reduction);
}
export const meanSquaredError =
  op({meanSquaredError_});

```

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```

=====
*/
import {Tensor} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assertShapesMatch} from '../util';
import {abs} from '../abs';
import {add} from './add';
import {exp} from './exp';
import {log1p} from './log1p';
import {Reduction} from
  '../loss_ops_utils';
import {mul} from './mul';
import {neg} from './neg';
import {op} from
  '../operation';
import {relu} from './relu';
import {scalar} from './scalar';
import {sub} from './sub';
import {computeWeightedLoss} from './compute_weighted_loss';
function sigmoidCrossEntropyWithLogits<T
  extends Tensor, O extends Tensor>(
  labels: T|TensorLike, logits: T|TensorLike): O {
  const $labels =
    convertToTensor(labels, 'labels', 'sigmoidCrossEntropyWithLogits');
  const $logits =
    convertToTensor(logits, 'logits', 'sigmoidCrossEntropyWithLogits');
  assertShapesMatch($labels.shape, $logits.shape, 'Error in sigmoidCrossEntropyWithLogits: ');
  /**
   * Implementation Details:
   * For brevity, let `x = logits`, `z
  
```


= labels`. The logistic loss is $z * \log(\text{sigmoid}(x)) + (1 - z) * \log(1 - \text{sigmoid}(x))$

$= z * \log(1 / (1 + \exp(-x))) + (1 - z) * \log(\exp(-x) / (1 + \exp(-x)))$

$= z * \log(1 + \exp(-x)) + (1 - z) * (-\log(\exp(-x)) + \log(1 + \exp(-x)))$

$= z * \log(1 + \exp(-x)) + (1 - z) * (x + \log(1 + \exp(-x)))$

$= (1 - z) * x + \log(1 + \exp(-x))$

For $x < 0$, to avoid overflow in $\exp(-x)$, we reformulate the above

$x - x * z + \log(1 + \exp(-x))$

$= \log(\exp(x)) - x * z + \log(1 + \exp(-x))$

$= -x * z + \log(1 + \exp(x))$

Hence, to ensure stability and avoid overflow, the implementation uses this equivalent formulation:

```

const maxOutput = relu($logits);
const outputXTarget = mul($logits, $labels);
const sigmoidOutput = log1p(exp(neg(abs($logits))));
return add(sub(maxOutput, outputXTarget), sigmoidOutput);

```

Computes the sigmoid cross entropy loss between two tensors.

If labelSmoothing is nonzero, smooth the labels towards 1/2:

```

newMulticlassLabels = multiclassLabels * (1 - labelSmoothing) + 0.5 * labelSmoothing

```

@param multiClassLabels The ground truth output tensor of shape [batch_size, num_classes], same dimensions as 'predictions'.

@param logits The predicted outputs.

@param weights Tensor whose rank is either 0, or the same rank as labels, and must be broadcastable to labels (i.e., all dimensions must be either 1, or the same as the corresponding losses dimension).

@param labelSmoothing If greater than 0, then smooth the labels.

@param reduction Type of reduction to apply to loss. Should be of type Reduction

```

@doc { heading: 'Training', subheading: 'Losses', namespace: 'losses' }
function sigmoidCrossEntropy_<T extends Tensor, O extends Tensor>(
  multiClassLabels: T|TensorLike, logits: T|TensorLike,
  weights?: Tensor|TensorLike, labelSmoothing = 0,
  reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {
  let $multiClassLabels = convertToTensor(multiClassLabels, 'multiClassLabels', 'sigmoidCrossEntropy');
  const $logits = convertToTensor(logits, 'logits', 'sigmoidCrossEntropy');
  let $weights: Tensor = null;
  if (weights != null) {
    $weights = convertToTensor(weights, 'weights', 'sigmoidCrossEntropy');
  }
  assertShapesMatch($multiClassLabels.shape, $logits.shape, 'Error in sigmoidCrossEntropy: ');
  if (labelSmoothing > 0) {
    const labelSmoothingScalar = scalar(labelSmoothing);
    const one = scalar(1);
    const half = scalar(0.5);
    $multiClassLabels = add(mul($multiClassLabels, sub(one, labelSmoothingScalar)), mul(half, labelSmoothingScalar));
  }
  const losses = sigmoidCrossEntropyWithLogits_($multiClassLabels, $logits);
  return computeWeightedLoss(losses, $weights, reduction);
}

```

export const sigmoidCrossEntropy = op({sigmoidCrossEntropy_});

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```

=====
import { customGrad } from '../gradients';
import { Tensor } from '../tensor';
import { GradSaveFunc } from '../tensor_types';
import { convertToTensor } from '../tensor_util_env';
import { TensorLike } from '../types';
import { assertShapesMatch } from '../util';
import { add } from './add';
import { expandShapeToKeepDim } from './axis_util';
import { cast } from './cast';
import { div } from './div';
import { exp } from './exp';
import { logSumExp } from './log_sum_exp';
import { Reduction } from './loss_ops_utils';
import { mul } from './mul';
import { neg } from './neg';
import { op } from './operation';
import { reshape } from './reshape';
import { scalar } from './scalar';
import { sub } from './sub';
import { sum } from './sum';
import { computeWeightedLoss } from './compute_weighted_loss';

```

Computes softmax cross entropy between logits and labels.

Measures the probability error in discrete classification tasks in which the classes are mutually exclusive (each entry is in exactly one class). For example, each CIFAR-10 image is labeled with one and only one label: an image can be a dog or a truck, but not both.

NOTE: While the classes are mutually exclusive, their probabilities need not be. All that is required is that each row of labels is a valid probability distribution. If they are not, the computation of the

```

gradient\n * will be incorrect.\n * \`WARNING\`: This op expects unscaled logits, since it performs a softmax
on\n * logits internally for efficiency. Do not call this op with the output of\n * softmax, as it will produce incorrect
results.\n * \n * logits and labels must have the same shape, e.g. [batch_size, num_classes]\n * and the same dtype.\n
* @param labels The labels array.\n * @param logits The logits array.\n * @param dim The dimension softmax
would be performed on. Defaults to -1\n * which indicates the last dimension.\n */\nfunction
softmaxCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(\n labels: T, logits: T, dim = -1): O {\n
if (dim === -1) {\n dim = logits.rank - 1;\n }\n\n if (dim !== logits.rank - 1) {\n throw Error(\n `Softmax
cross entropy along a non-last dimension is not yet ` +\n `supported. Labels / logits was rank ${logits.rank} `
+\n `and dim was ${dim}`);\n }\n // Use a custom gradient for numerical stability.\n const customOp =\n customGrad((labels: Tensor, logits: Tensor, save: GradSaveFunc) => {\n // Reference:\n // 1.
http://cs231n.github.io/linear-classify/#softmax\n // 2. https://blog.feedly.com/tricks-of-the-trade-logsumexp/\n
const keepDims = true;\n const lse = logSumExp(logits, [dim], keepDims);\n const logResult =
sub(cast(logits, 'float32'), lse);\n save([labels, logResult]);\n\n const costVector = neg(mul(logResult,
labels));\n const value: O = sum(costVector, [dim]);\n\n const gradFunc = (dy: O, saved: Tensor[]) => {\n
const [labels, logResult] = saved;\n const dyShape = expandShapeToKeepDim(dy.shape, [dim]);\n
return [\n mul(reshape(dy, dyShape),\n sub(cast(labels, 'float32'), exp(logResult))),\n
mul(reshape(dy, dyShape),\n sub(exp(logResult), cast(labels, 'float32'))),\n ];\n };\n return
{value, gradFunc};\n });\n\n return customOp(labels, logits);\n }\n\n/**\n * Computes the softmax cross entropy
loss between two tensors.\n * \n * If labelSmoothing is nonzero, smooth the labels towards 1/2.\n * \n *
newOnehotLabels = onehotLabels * (1 - labelSmoothing)\n * + labelSmoothing / numClasses\n * \n *
@param onehotLabels One hot encoded labels\n * [batch_size, num_classes], same dimensions as 'predictions'.\n
* @param logits The predicted outputs.\n * @param weights Tensor whose rank is either 0, or 1, and must be\n *
broadcastable to `loss` of shape [batch_size]\n * @param labelSmoothing If greater than 0, then smooth the
labels.\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * \n * @doc
{ heading: 'Training', subheading: 'Losses', namespace: 'losses' }\n */\nfunction softmaxCrossEntropy_<T extends
Tensor, O extends Tensor>(\n onehotLabels: T|TensorLike, logits: T|TensorLike,\n weights?:
Tensor|TensorLike, labelSmoothing = 0,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let
$onehotLabels =\n convertToTensor(onehotLabels, 'onehotLabels', 'softmaxCrossEntropy');\n const $logits =
convertToTensor(logits, 'logits', 'softmaxCrossEntropy');\n let $weights: Tensor = null;\n\n if (weights !== null) {\n
$weights = convertToTensor(weights, 'weights', 'softmaxCrossEntropy');\n }\n\n assertShapesMatch(\n
$onehotLabels.shape, $logits.shape, 'Error in softmaxCrossEntropy: '); \n\n if (labelSmoothing > 0) {\n const
labelSmoothingScalar = scalar(labelSmoothing);\n const one = scalar(1);\n const numClasses =
scalar($onehotLabels.shape[1]);\n\n $onehotLabels =\n add(mul($onehotLabels, sub(one,
labelSmoothingScalar)),\n div(labelSmoothingScalar, numClasses));\n }\n\n const losses =
softmaxCrossEntropyWithLogits_($onehotLabels, $logits);\n\n return computeWeightedLoss(losses, $weights,
reduction);\n }\n\nexport const softmaxCrossEntropy = op({softmaxCrossEntropy_});\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\n// Modularized ops.\nexport {abs} from './abs';\nexport {acos} from './acos';\nexport {acosh} from
 './acosh';\nexport {add} from './add';\nexport {addN} from './add_n';\nexport {all} from './all';\nexport {any} from
 './any';\nexport {argMax} from './arg_max';\nexport {argMin} from './arg_min';\nexport {asin} from './asin';\nexport
{asinh} from './asinh';\nexport {atan} from './atan';\nexport {atan2} from './atan2';\nexport {atanh} from
 './atanh';\nexport {avgPool} from './avg_pool';\nexport {avgPool3d} from './avg_pool_3d';\nexport

```

{basicLSTMCell} from './basic_lstm_cell';\nextport {batchToSpaceND} from './batch_to_space_nd';\nextport {batchNorm} from './batchnorm';\nextport {batchNorm2d} from './batchnorm2d';\nextport {batchNorm3d} from './batchnorm3d';\nextport {batchNorm4d} from './batchnorm4d';\nextport {bincount} from './bincount';\nextport {broadcastTo} from './broadcast_to';\nextport {buffer} from './buffer';\nextport {cast} from './cast';\nextport {ceil} from './ceil';\nextport {clipByValue} from './clip_by_value';\nextport {clone} from './clone';\nextport {complex} from './complex';\nextport {concat} from './concat';\nextport {concat1d} from './concat_1d';\nextport {concat2d} from './concat_2d';\nextport {concat3d} from './concat_3d';\nextport {concat4d} from './concat_4d';\nextport {conv1d} from './conv1d';\nextport {conv2d} from './conv2d';\nextport {conv2dTranspose} from './conv2d_transpose';\nextport {conv3d} from './conv3d';\nextport {conv3dTranspose} from './conv3d_transpose';\nextport {cos} from './cos';\nextport {cosh} from './cosh';\nextport {cumsum} from './cumsum';\nextport {denseBincount} from './dense_bincount';\nextport {depthToSpace} from './depth_to_space';\nextport {depthwiseConv2d} from './depthwise_conv2d';\nextport {diag} from './diag';\nextport {dilation2d} from './dilation2d';\nextport {div} from './div';\nextport {divNoNaN} from './div_no_nan';\nextport {dot} from './dot';\nextport {elu} from './elu';\nextport {equal} from './equal';\nextport {erf} from './erf';\nextport {exp} from './exp';\nextport {expandDims} from './expand_dims';\nextport {expm1} from './expm1';\nextport {eye} from './eye';\nextport {fill} from './fill';\nextport {floor} from './floor';\nextport {floorDiv} from './floorDiv';\nextport {gather} from './gather';\nextport {greater} from './greater';\nextport {greaterEqual} from './greater_equal';\nextport {imag} from './imag';\nextport {isFinite} from './is_finite';\nextport {isInf} from './is_inf';\nextport {isNaN} from './is_nan';\nextport {leakyRelu} from './leaky_relu';\nextport {less} from './less';\nextport {lessEqual} from './less_equal';\nextport {linspace} from './linspace';\nextport {localResponseNormalization} from './local_response_normalization';\nextport {log} from './log';\nextport {log1p} from './log1p';\nextport {logSigmoid} from './log_sigmoid';\nextport {logSoftmax} from './log_softmax';\nextport {logSumExp} from './log_sum_exp';\nextport {logicalAnd} from './logical_and';\nextport {logicalNot} from './logical_not';\nextport {logicalOr} from './logical_or';\nextport {logicalXor} from './logical_xor';\nextport {matMul} from './mat_mul';\nextport {max} from './max';\nextport {maxPool} from './max_pool';\nextport {maxPool3d} from './max_pool_3d';\nextport {maxPoolWithArgmax} from './max_pool_with_argmax';\nextport {maximum} from './maximum';\nextport {mean} from './mean';\nextport {min} from './min';\nextport {minimum} from './minimum';\nextport {mirrorPad} from './mirror_pad';\nextport {mod} from './mod';\nextport {moments} from './moments';\nextport {mul} from './mul';\nextport {LSTMCellFunc, multiRNNCell} from './multi_rnn_cell';\nextport {multinomial} from './multinomial';\nextport {neg} from './neg';\nextport {notEqual} from './not_equal';\nextport {oneHot} from './one_hot';\nextport {ones} from './ones';\nextport {onesLike} from './ones_like';\nextport {outerProduct} from './outer_product';\nextport {pad} from './pad';\nextport {pad1d} from './pad1d';\nextport {pad2d} from './pad2d';\nextport {pad3d} from './pad3d';\nextport {pad4d} from './pad4d';\nextport {pool} from './pool';\nextport {pow} from './pow';\nextport {prelu} from './prelu';\nextport {print} from './print';\nextport {prod} from './prod';\nextport {rand} from './rand';\nextport {randomGamma} from './random_gamma';\nextport {randomNormal} from './random_normal';\nextport {randomUniform} from './random_uniform';\nextport {range} from './range';\nextport {real} from './real';\nextport {reciprocal} from './reciprocal';\nextport {relu} from './relu';\nextport {relu6} from './relu6';\nextport {reshape} from './reshape';\nextport {reverse} from './reverse';\nextport {reverse1d} from './reverse_1d';\nextport {reverse2d} from './reverse_2d';\nextport {reverse3d} from './reverse_3d';\nextport {reverse4d} from './reverse_4d';\nextport {round} from './round';\nextport {rsqrt} from './rsqrt';\nextport {scalar} from './scalar';\nextport {selu} from './selu';\nextport {separableConv2d} from './separable_conv2d';\nextport {setdiff1dAsync} from './setdiff1d_async';\nextport {sigmoid} from './sigmoid';\nextport {sign} from './sign';\nextport {sin} from './sin';\nextport {sinh} from './sinh';\nextport {slice} from './slice';\nextport {slice1d} from './slice1d';\nextport {slice2d} from './slice2d';\nextport {slice3d} from './slice3d';\nextport {slice4d} from './slice4d';\nextport {softmax} from './softmax';\nextport {softplus} from './softplus';\nextport {spaceToBatchND} from './space_to_batch_nd';\nextport {fft} from './spectral/fft';\nextport {ifft} from './spectral/ifft';\nextport {irfft} from './spectral/irfft';\nextport {rfft} from './spectral/rfft';\nextport {split} from './split';\nextport {sqrt} from './sqrt';\nextport {square} from './square';\nextport {squaredDifference} from './squared_difference';\nextport {squeeze} from './squeeze';\nextport {stack} from './stack';\nextport {step} from

* The `originalName` field is required for keeping track of the canonical name of the variable, which is usually the name of the model weight that the variable is related to plus a suffix, e.g., 'dense1/kernel/momentum'. The name of the `Variable` object itself cannot be used directly due to possible deduplication: Every `Variable` must have a unique name but more than one optimizer objects of the same type may be created for the same model or the same `Variable`.

```

export interface OptimizerVariable {
  originalName: string;
  variable: Variable;
}

/** @doc {heading: 'Training', subheading: 'Classes', namespace: 'train'}
 * An abstract class Optimizer extends Serializable
 * protected iterations_: number;
 * Executes `f()` and minimizes the scalar output of `f()` by computing
 * gradients of y with respect to the list of trainable variables provided by
 * `varList`. If no list is provided, it defaults to all trainable variables.
 * @param f The function to execute and whose output to minimize.
 * @param returnCost Whether to return the scalar cost value produced by
 * executing `f()`.
 * @param varList An optional list of variables to update. If specified, only
 * the trainable variables in varList will be updated by minimize. Defaults to
 * all trainable variables.
 * @doc {heading: 'Training', subheading: 'Optimizers'}
 * minimize(f: () => Scalar, returnCost = false, varList?: Variable[]):
 * Scalar | null
 * const {value, grads} = this.computeGradients(f, varList);
 * if (varList != null) {
 *   const gradArray: NamedTensor[] =
 *     varList.map(v => ({name: v.name, tensor: grads[v.name]}));
 *   this.applyGradients(gradArray);
 * } else {
 *   this.applyGradients(grads);
 * }
 * // Dispose gradients.
 * dispose(grads);
 * if (returnCost) {
 *   return value;
 * } else {
 *   value.dispose();
 *   return null;
 * }
 * }
 * /**
 * The number of iterations that this optimizer instance has been invoked for.
 * get iterations(): number
 * if (this.iterations_ == null) {
 *   this.iterations_ = 0;
 * }
 * return this.iterations_;
 * }
 * protected incrementIterations() {
 *   this.iterations_ = this.iterations + 1;
 * }
 * /**
 * Executes f() and computes the gradient of the scalar output of f() with
 * respect to the list of trainable variables provided by `varList`. If no
 * list is provided, it defaults to all trainable variables.
 * @param f The function to execute and whose output to use for computing
 * gradients with respect to variables.
 * @param varList An optional list of variables to compute gradients with
 * respect to. If specified, only the trainable variables in varList will
 * have gradients computed with respect to. Defaults to all trainable variables.
 * @doc {heading: 'Training', subheading: 'Optimizers'}
 * computeGradients(f: () => Scalar, varList?: Variable[]):
 * {value: Scalar, grads: NamedTensorMap}
 * return variableGrads(f, varList);
 * }
 * /**
 * Updates variables by using the computed gradients.
 * @param variableGrads A mapping of variable name to its gradient value.
 * @doc {heading: 'Training', subheading: 'Optimizers'}
 * abstract
 * applyGradients(variableGrads: NamedTensorMap)
 * NamedTensor[]): void;
 * /**
 * Dispose the variables (if any) owned by this optimizer instance.
 * dispose(): void
 * if (this.iterations_ != null) {
 *   dispose(this.iterations_);
 * }
 * }
 * async saveIterations(): Promise<NamedTensor>
 * if (this.iterations_ == null) {
 *   this.iterations_ = 0;
 * }
 * return {
 *   name: 'iter', // Named for Python compatibility.
 *   // TODO(cais): Use 'int64' type when available.
 *   tensor: scalar(this.iterations_, 'int32')
 * };
 * }
 * async getWeights(): Promise<NamedTensor[]>
 * throw new Error('getWeights() is not implemented for this optimizer yet.');
```

```

 * }
 * async setWeights(weightValues: NamedTensor[]): Promise<void>
 * throw new Error(
 *   `setWeights() is not implemented for this optimizer class ` +
 *   `${this.getClassName()}`);
 * }
 * /**
 * Extract the first element of the weight values and set it
 * as the iterations counter variable of this instance of optimizer.
 * @param weightValues
 * @returns Weight values with the first element consumed and excluded.
 * protected async extractIterations(weightValues: NamedTensor[]):
 * Promise<NamedTensor[]>
 * this.iterations_ = (await weightValues[0].tensor.data())[0];
 * return weightValues.slice(1);
 * }
 * }
 * Object.defineProperty(Optimizer, Symbol.hasInstance, {
 *   value: (instance: Optimizer) => {
 *     return instance.minimize != null && instance.computeGradients != null &&
 *     instance.applyGradients != null;
 *   }
 * });
 * /**
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```

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```
=====
*/\n\nimport {ENGINE} from './engine';\nimport {dispose, tidy} from './globals';\nimport {add} from './ops/add';\nimport {div} from './ops/div';\nimport {mul} from './ops/mul';\nimport {sqrt} from './ops/ops';\nimport {square} from './ops/square';\nimport {zerosLike} from './ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from './serialization';\nimport {NamedTensor, NamedVariableMap} from './tensor_types';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/** @doclink Optimizer */\nexport class AdadeltaOptimizer extends Optimizer {\n  /** @nocollapse */\n  static className = 'Adadelta'; // Name matters for Python compatibility.\n  private accumulatedGrads: OptimizerVariable[] = [];\n  private accumulatedUpdates: OptimizerVariable[] = [];\n\n  constructor(\n    protected learningRate: number, protected rho: number, protected epsilon: number = null) {\n    super();\n\n    if (epsilon == null) {\n      this.epsilon = ENGINE.backend.epsilon();\n    }\n\n    applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n      const variableNames = Array.isArray(variableGradients) ?\n        variableGradients.map(item => item.name) :\n        Object.keys(variableGradients);\n\n      variableNames.forEach((name, i) => {\n        const value = ENGINE.registeredVariables[name];\n        const trainable = false;\n        if (this.accumulatedGrads[i] == null) {\n          this.accumulatedGrads[i] = {\n            originalName: `${name}/accum_grad`,\n            variable: tidy(() => zerosLike(value).variable(trainable))\n          };\n        }\n        if (this.accumulatedUpdates[i] == null) {\n          this.accumulatedUpdates[i] = {\n            originalName: `${name}/accum_var`,\n            variable: tidy(() => zerosLike(value).variable(trainable))\n          };\n        }\n        const gradient = Array.isArray(variableGradients) ?\n          variableGradients[i].tensor :\n          variableGradients[name];\n        if (gradient == null) {\n          return;\n        }\n        const accumulatedGrad = this.accumulatedGrads[i].variable;\n        const accumulatedUpdate = this.accumulatedUpdates[i].variable;\n        tidy(() => {\n          const newAccumulatedGrad =\n            add(mul(accumulatedGrad, this.rho),\n              mul(square(gradient), 1 - this.rho));\n          const updates =\n            mul(div(sqrt(add(accumulatedUpdate, this.epsilon)),\n              sqrt(add(accumulatedGrad, this.epsilon))),\n              gradient);\n          const newAccumulatedUpdate =\n            add(mul(accumulatedUpdate, this.rho),\n              mul(square(updates), 1 - this.rho));\n          accumulatedGrad.assign(newAccumulatedGrad);\n          accumulatedUpdate.assign(newAccumulatedUpdate);\n          const newValue = add(mul(updates, -this.learningRate), value);\n          value.assign(newValue);\n        });\n      });\n      this.incrementIterations();\n    }\n\n  dispose(): void {\n    if (this.accumulatedUpdates != null) {\n      dispose(this.accumulatedGrads.map(v => v.variable));\n      dispose(this.accumulatedUpdates.map(v => v.variable));\n    }\n  }\n\n  async getWeights(): Promise<NamedTensor[]> {\n    // Order matters for Python compatibility.\n    const variables: OptimizerVariable[] =\n      [...this.accumulatedGrads, ...this.accumulatedUpdates];\n    return [await this.saveIterations().concat(\n      variables.map(v => ({name: v.originalName, tensor: v.variable})));\n    ]\n  }\n\n  async setWeights(weightValues: NamedTensor[]): Promise<void> {\n    weightValues = await this.extractIterations(weightValues);\n    const variableCount = weightValues.length / 2;\n    const trainable = false;\n    this.accumulatedGrads =\n      weightValues.slice(0, variableCount).map(v => ({\n        originalName: v.name,\n        variable: v.tensor.variable(\n          trainable)\n        }));\n    this.accumulatedUpdates =\n      weightValues.slice(variableCount, variableCount * 2)\n      .map(v => ({\n        originalName: v.name,\n        variable: v.tensor.variable(trainable)\n      }));\n  }\n\n  getConfig(): ConfigDict {\n    return {\n      'learningRate': this.learningRate,\n      'rho': this.rho,\n      'epsilon': this.epsilon\n    };\n  }\n\n  /** @nocollapse */\n  static fromConfig<T> extends Serializable>(\n    cls: SerializableConstructor<T>, config: ConfigDict): T {\n    return new cls(config['learningRate'], config['rho'], config['epsilon']);\n  }\n\n  registerClass(AdadeltaOptimizer);\n}\n\n/** @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
```

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```
=====\n*\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from '../ops/add';\nimport {div} from '../ops/div';\nimport {fill} from '../ops/fill';\nimport {mul} from '../ops/mul';\nimport {sqrt} from '../ops/sqrt';\nimport {square} from '../ops/square';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\n/** @doclink Optimizer */\nexport class AdagradOptimizer extends Optimizer {\n  /** @nocollapse */\n  static className = 'Adagrad'; // Note: Name matters for Python compatibility.\n\n  private accumulatedGrads: OptimizerVariable[] = [];\n\n  constructor(\n    protected learningRate: number, private initialAccumulatorValue = 0.1) {\n    super();\n  }\n\n  applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n    const variableNames = Array.isArray(variableGradients) ?\n      variableGradients.map(item => item.name) :\n      Object.keys(variableGradients);\n\n    variableNames.forEach((name, i) => {\n      const value = ENGINE.registeredVariables[name];\n      if (this.accumulatedGrads[i] == null) {\n        const trainable = false;\n        this.accumulatedGrads[i] = {\n          originalName: `${name}/accumulator`,\n          variable: tidy(\n            () => fill(value.shape, this.initialAccumulatorValue)\n              .variable(trainable))\n        };\n        const gradient = Array.isArray(variableGradients) ?\n          variableGradients[i].tensor :\n          variableGradients[name];\n        if (gradient == null) {\n          return;\n        }\n        const accumulatedGrad = this.accumulatedGrads[i].variable;\n        tidy(() => {\n          const newAccumulatedGrad = add(accumulatedGrad, square(gradient));\n          accumulatedGrad.assign(newAccumulatedGrad);\n          const newValue = add(\n            mul(div(gradient,\n              sqrt(add(newAccumulatedGrad, ENGINE.backend.epsilon()))),\n              this.learningRate),\n            value);\n          value.assign(newValue);\n        });\n        this.incrementIterations();\n      }\n\n      dispose(): void {\n        if (this.accumulatedGrads != null) {\n          dispose(this.accumulatedGrads.map(v => v.variable));\n        }\n      }\n\n      async getWeights(): Promise<NamedTensor[]> {\n        // Order matters for Python compatibility.\n        return [await this.saveIterations()].concat(this.accumulatedGrads.map(\n          v => ({name: v.originalName, tensor: v.variable}));\n      }\n\n      async setWeights(weightValues: NamedTensor[]): Promise<void> {\n        weightValues = await this.extractIterations(weightValues);\n        const trainable = false;\n        this.accumulatedGrads = weightValues.map(\n          v => ({originalName: v.name, variable: v.tensor.variable(trainable)});\n        );\n      }\n\n      getConfig(): ConfigDict {\n        return {\n          'learningRate': this.learningRate,\n          'initialAccumulatorValue': this.initialAccumulatorValue,\n        };\n      }\n\n      /** @nocollapse */\n      static fromConfig<T extends Serializable>(\n        cls: SerializableConstructor<T>, config: ConfigDict): T {\n        return new cls(config['learningRate'], config['initialAccumulatorValue']);\n      }\n\n      registerClass(AdagradOptimizer);\n    }, /**\n     * @license\n     * Copyright 2018 Google LLC. All Rights Reserved.\n     * Licensed under the Apache License, Version 2.0 (the \"License\");\n     * you may not use this file except in compliance with the License.\n     * You may obtain a copy of the License at\n     * http://www.apache.org/licenses/LICENSE-2.0\n     * Unless required by applicable law or agreed to in writing,\n     * software\n     * distributed under the License is distributed on an \"AS IS\" BASIS,\n     * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for the specific language governing permissions and\n     * limitations under the License.\n     */\n    )\n  }\n\n  *\n\n  import {ENGINE} from '../engine';\n  import {dispose, tidy} from '../globals';\n  import {add} from '../ops/add';\n  import {div} from '../ops/div';\n  import {mul} from '../ops/mul';\n  import {pow} from '../ops/pow';\n  import {scalar} from '../ops/scalar';\n  import {sqrt} from '../ops/sqrt';\n  import {square} from '../ops/square';\n  import {sub} from '../ops/sub';\n  import {zerosLike} from '../ops/zeros_like';\n  import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\n  import {Variable} from '../tensor';\n  import {NamedTensor, NamedVariableMap} from '../tensor_types';\n  import {Optimizer,
```

```

OptimizerVariable} from './optimizer';\n\nexport class AdamOptimizer extends Optimizer {\n  /** @nocollapse */\n  static className = 'Adam'; // Note: Name matters for Python compatibility.\n  private accBeta1: Variable;\n  private accBeta2: Variable;\n  private accumulatedFirstMoment: OptimizerVariable[] = [];\n  private accumulatedSecondMoment: OptimizerVariable[] = [];\n\n  constructor(\n    protected learningRate: number,\n    protected beta1: number,\n    protected beta2: number, protected epsilon: number = null) {\n    super();\n    tidy(() => {\n      // accB* will be updated by batch.\n      this.accBeta1 = scalar(beta1).variable();\n      this.accBeta2 = scalar(beta2).variable();\n    });\n\n    if (epsilon == null) {\n      this.epsilon = ENGINE.backend.epsilon();\n    }\n\n    applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n      const varNames = Array.isArray(variableGradients) ?\n        variableGradients.map(v => v.name) :\n        Object.keys(variableGradients);\n      tidy(() => {\n        const oneMinusAccBeta1 = sub(1, this.accBeta1);\n        const oneMinusAccBeta2 = sub(1, this.accBeta2);\n\n        varNames.forEach((name, i) => {\n          const value = ENGINE.registeredVariables[name];\n          const trainable = false;\n          if (this.accumulatedFirstMoment[i] == null) {\n            this.accumulatedFirstMoment[i] = {\n              originalName: `${name}/m`,\n              variable: tidy(() => zerosLike(value).variable(trainable))\n            };\n          }\n          if (this.accumulatedSecondMoment[i] == null) {\n            this.accumulatedSecondMoment[i] = {\n              originalName: `${name}/v`,\n              variable: tidy(() => zerosLike(value).variable(trainable))\n            };\n          }\n\n          const gradient = Array.isArray(variableGradients) ?\n            variableGradients[i].tensor :\n            variableGradients[name];\n          if (gradient == null) {\n            return;\n          }\n\n          const firstMoment = this.accumulatedFirstMoment[i].variable;\n          const secondMoment = this.accumulatedSecondMoment[i].variable;\n\n          const newFirstMoment =\n            add(mul(firstMoment, this.beta1), mul(gradient, 1 - this.beta1));\n          const newSecondMoment =\n            add(mul(secondMoment, this.beta2),\n              mul(square(gradient), 1 - this.beta2));\n\n          const biasCorrectedFirstMoment =\n            div(newFirstMoment, oneMinusAccBeta1);\n          const biasCorrectedSecondMoment =\n            div(newSecondMoment, oneMinusAccBeta2);\n\n          firstMoment.assign(newFirstMoment);\n          secondMoment.assign(newSecondMoment);\n\n          const newValue =\n            add(mul(div(biasCorrectedFirstMoment,\n              -this.learningRate),\n              add(sqrt(biasCorrectedSecondMoment), this.epsilon)),\n              value);\n          value.assign(newValue);\n        });\n\n        this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n        this.accBeta2.assign(mul(this.accBeta2, this.beta2));\n      });\n      this.incrementIterations();\n    }\n\n    dispose(): void {\n      this.accBeta1.dispose();\n      this.accBeta2.dispose();\n      if (this.accumulatedFirstMoment != null) {\n        dispose(this.accumulatedFirstMoment.map(v => v.variable));\n      }\n      if (this.accumulatedSecondMoment != null) {\n        dispose(this.accumulatedSecondMoment.map(v => v.variable));\n      }\n    }\n\n    async getWeights(): Promise<NamedTensor[]> {\n      // Order matters for Python compatibility.\n      const variables: OptimizerVariable[] =\n        [...this.accumulatedFirstMoment, ...this.accumulatedSecondMoment];\n      return [await this.saveIterations()].concat(\n        variables.map(v => ({name: v.originalName, tensor: v.variable}));\n      );\n\n      async setWeights(weightValues: NamedTensor[]): Promise<void> {\n        weightValues = await this.extractIterations(weightValues);\n        tidy(() => {\n          this.accBeta1.assign(pow(this.beta1, this.iterations_ + 1));\n          this.accBeta2.assign(pow(this.beta2, this.iterations_ + 1));\n        });\n        const variableCount = weightValues.length / 2;\n        const trainable = false;\n        this.accumulatedFirstMoment =\n          weightValues.slice(0, variableCount).map(v => ({\n            originalName: v.name,\n            variable: v.tensor.variable(\n              trainable\n            )));\n        this.accumulatedSecondMoment =\n          weightValues.slice(variableCount, variableCount * 2)\n            .map(v => ({\n              originalName: v.name,\n              variable: v.tensor.variable(trainable)\n            }));\n      }\n\n      getConfig(): ConfigDict {\n        return {\n          'learningRate': this.learningRate,\n          'beta1': this.beta1,\n          'beta2': this.beta2,\n          'epsilon': this.epsilon,\n        };\n      }\n\n      /** @nocollapse */\n      static fromConfig<T> extends Serializable>(\n        cls: SerializableConstructor<T>, config: ConfigDict): T {\n        return new cls(\n          config['learningRate'], config['beta1'], config['beta2'],\n          config['epsilon']);\n      }\n\n      registerClass(AdamOptimizer);\n    },\n    /**\n     * @license\n     * Copyright 2018 Google LLC. 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```


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```
=====\n*\n\nimport {ENGINE} from './engine';\nimport {dispose, tidy} from './globals';\nimport {abs} from './ops/abs';\nimport {add} from './ops/add';\nimport {div} from './ops/div';\nimport {maximum} from './ops/maximum';\nimport {mul} from './ops/mul';\nimport {scalar} from './ops/scalar';\nimport {sub} from './ops/sub';\nimport {zerosLike} from './ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from './serialization';\nimport {Variable} from './tensor';\nimport {NamedTensor, NamedVariableMap} from './tensor_types';\n\nimport {Optimizer, OptimizerVariable} from './optimizer';\n\nexport class AdamaxOptimizer extends Optimizer {\n  /** @nocollapse */\n  static className = 'Adamax'; // Note: Name matters for Python compatibility.\n  private accBeta1: Variable;\n  private iteration: Variable;\n  private accumulatedFirstMoment: OptimizerVariable[] = [];\n  private accumulatedWeightedInfNorm: OptimizerVariable[] = [];\n\n  constructor(\n    protected learningRate: number, protected beta1: number,\n    protected beta2: number, protected epsilon: number = null,\n    protected decay = 0.0) {\n    super();\n\n    tidy(() => {\n      this.iteration = scalar(0).variable();\n      this.accBeta1 = scalar(beta1).variable();\n    });\n\n    if (epsilon == null) {\n      this.epsilon = ENGINE.backend.epsilon();\n    }\n  }\n\n  applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n    const variableNames = Array.isArray(variableGradients) ?\n      variableGradients.map(item => item.name) :\n      Object.keys(variableGradients);\n\n    tidy(() => {\n      const oneMinusAccBeta1 = sub(1, this.accBeta1);\n      const lr =\n        div(-this.learningRate, add(mul(this.iteration, this.decay), 1));\n\n      variableNames.forEach((name, i) => {\n        const value = ENGINE.registeredVariables[name];\n        const trainable = false;\n        if (this.accumulatedFirstMoment[i] == null) {\n          this.accumulatedFirstMoment[i] = {\n            originalName: `${name}/m`,\n            variable: zerosLike(value).variable(trainable)\n          };\n        }\n        if (this.accumulatedWeightedInfNorm[i] == null) {\n          this.accumulatedWeightedInfNorm[i] = {\n            originalName: `${name}/v`,\n            variable: zerosLike(value).variable(trainable)\n          };\n        }\n\n        const gradient = Array.isArray(variableGradients) ?\n          variableGradients[i].tensor :\n          variableGradients[name];\n        if (gradient == null) {\n          return;\n        }\n\n        const firstMoment = this.accumulatedFirstMoment[i].variable;\n        const weightedInfNorm = this.accumulatedWeightedInfNorm[i].variable;\n\n        const newFirstMoment =\n          add(mul(firstMoment, this.beta1), mul(gradient, 1 - this.beta1));\n\n        const ut0 = mul(weightedInfNorm, this.beta2);\n        const ut1 = abs(gradient);\n\n        const newWeightedInfNorm = maximum(ut0, ut1);\n\n        firstMoment.assign(newFirstMoment);\n        weightedInfNorm.assign(newWeightedInfNorm);\n\n        const newValue =\n          add(mul(div(lr, oneMinusAccBeta1),\n            div(newFirstMoment, add(newWeightedInfNorm, this.epsilon))),\n            value);\n\n        value.assign(newValue);\n      });\n\n      this.iteration.assign(add(this.iteration, 1));\n      this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n    });\n\n    this.incrementIterations();\n  }\n\n  dispose(): void {\n    this.accBeta1.dispose();\n    this.iteration.dispose();\n\n    if (this.accumulatedFirstMoment != null) {\n      dispose(this.accumulatedFirstMoment.map(v => v.variable));\n    }\n\n    if (this.accumulatedWeightedInfNorm != null) {\n      dispose(this.accumulatedWeightedInfNorm.map(v => v.variable));\n    }\n  }\n\n  async getWeights(): Promise<NamedTensor[]> {\n    throw new Error('getWeights() is not implemented for Adamax yet.);\n  }\n\n  async setWeights(weightValues: NamedTensor[]): Promise<void> {\n    throw new Error('setWeights() is not implemented for Adamax yet.);\n  }\n\n  getConfig(): ConfigDict {\n    return {\n      'learningRate': this.learningRate,\n      'beta1': this.beta1,\n      'beta2': this.beta2,\n      'epsilon': this.epsilon,\n      'decay': this.decay\n    };\n  }\n\n  /** @nocollapse */\n  static fromConfig<T> extends Serializable>(\n    cls: SerializableConstructor<T>, config: ConfigDict): T {\n    return new cls(\n      config['learningRate'],\n      config['beta1'],\n      config['beta2'],\n      config['epsilon'],\n      config['decay']\n    );\n  }\n\n  registerClass(AdamaxOptimizer);\n  /**\n * @license\n * Copyright 2018 Google LLC. All Rights
```

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```
=====\n*\n\nimport {ENGINE} from '../engine';\nimport {keep, tidy} from '../globals';\nimport {add} from '../ops/add';\nimport {mul} from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {Scalar} from '../tensor';\nimport {NamedTensor, NamedTensorMap} from '../tensor_types';\n\nimport {Optimizer} from './optimizer';\n\n/**\n * @doclink Optimizer\n */\nexport class SGDOptimizer extends Optimizer {\n  /** @nocollapse\n   *\n   * static className = 'SGD'; // Note: Name matters for Python compatibility.\n   *\n   * protected c: Scalar;\n   *\n   * constructor(protected learningRate: number) {\n   *   super();\n   *   this.setLearningRate(learningRate);\n   * }\n   *\n   * applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n   *   const varNames = Array.isArray(variableGradients) ?\n   *     variableGradients.map(v => v.name) :\n   *     Object.keys(variableGradients);\n   *   varNames.forEach((name, i) => {\n   *     const gradient = Array.isArray(variableGradients) ?\n   *       variableGradients[i].tensor :\n   *       variableGradients[name];\n   *     if (gradient == null) {\n   *       return;\n   *     }\n   *     const value = ENGINE.registeredVariables[name];\n   *     tidy(() => {\n   *       const newValue = add(mul(this.c, gradient), value);\n   *       value.assign(newValue);\n   *     });\n   *   });\n   *   this.incrementIterations();\n   * }\n   *\n   * Sets the learning rate of the optimizer.\n   *\n   * setLearningRate(learningRate: number) {\n   *   this.learningRate = learningRate;\n   *   if (this.c != null) {\n   *     this.c.dispose();\n   *   }\n   *   this.c = keep(scalar(-learningRate));\n   * }\n   *\n   * dispose() {\n   *   this.c.dispose();\n   * }\n   *\n   * async getWeights(): Promise<NamedTensor[]> {\n   *   return [await this.saveIterations()];\n   * }\n   *\n   * async setWeights(weightValues: NamedTensor[]): Promise<void> {\n   *   weightValues = await this.extractIterations(weightValues);\n   *   if (weightValues.length !== 0) {\n   *     throw new Error('SGD optimizer does not have settable weights.);\n   *   }\n   * }\n   *\n   * getConfig(): ConfigDict {\n   *   return {'learningRate': this.learningRate};\n   * }\n   *\n   * @nocollapse\n   *\n   * static fromConfig<T extends Serializable>(\n   *   cls: SerializableConstructor<T>, config: ConfigDict): T {\n   *   return new cls(config['learningRate']);\n   * }\n   *}\n\nregisterClass(SGDOptimizer);\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

=====\n*\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from '../ops/add';\nimport {mul} from '../ops/mul';\nimport {scalar} from '../ops/scalar';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {Scalar, Tensor} from '../tensor';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\n\nimport {OptimizerVariable} from './optimizer';\nimport {SGDOptimizer} from './sgd_optimizer';\n\n/**\n * @doclink Optimizer\n */\nexport class MomentumOptimizer extends SGDOptimizer {\n /** @nocollapse\n *\n * static className = 'Momentum'; // Name matters for Python compatibility.\n *\n * private m: Scalar;\n *\n * private accumulations: OptimizerVariable[] = [];\n *\n * constructor(\n * protected learningRate: number,\n * private momentum: number,\n * private useNesterov = false) {\n * super(learningRate);\n * this.m = scalar(this.momentum);\n * }\n *\n * applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n * const variableNames = Array.isArray(variableGradients) ?\n * variableGradients.map(item => item.name) :\n

```

Object.keys(variableGradients);\n\n  variableNames.forEach((name, i) => {\n    const value =
ENGINE.registeredVariables[name];\n    if (this.accumulations[i] == null) {\n      const trainable = false;\n      this.accumulations[i] = {\n        originalName: `${name}/momentum`,\n        variable: tidy(() =>
zerosLike(value).variable(trainable))\n      };\n    }\n\n    const accumulation = this.accumulations[i].variable;\n    const gradient = Array.isArray(variableGradients) ?\n      variableGradients[i].tensor :\n      variableGradients[name];\n    if (gradient == null) {\n      return;\n    }\n\n    tidy(() => {\n      let newValue:
Tensor;\n      const newAccumulation = add(mul(this.m, accumulation), gradient);\n      if (this.useNesterov) {\n        newValue = add(\n          mul(this.c, add(gradient, mul(newAccumulation, this.m))), value);\n      } else {\n        newValue = add(mul(this.c, newAccumulation), value);\n      }\n      accumulation.assign(newAccumulation);\n      value.assign(newValue);\n    });\n  });\n  this.incrementIterations();\n}\n\n dispose(): void {\n  this.m.dispose();\n  if (this.accumulations != null) {\n    dispose(this.accumulations.map(v => v.variable));\n  }\n}\n\n /**\n * Sets the momentum of the optimizer.\n * @param momentum\n */\nsetMomentum(momentum: number) {\n  this.momentum = momentum;\n}\n\n async getWeights():
Promise<NamedTensor[]> {\n  // Order matters for Python compatibility.\n  return [await
this.saveIterations()].concat(this.accumulations.map(\n    v => ({name: v.originalName, tensor: v.variable}));\n}\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n  weightValues = await
this.extractIterations(weightValues);\n  const trainable = false;\n  this.accumulations = weightValues.map(\n    v => ({originalName: v.name, variable: v.tensor.variable(trainable)});\n  );\n\n  getConfig(): ConfigDict {\n    return
{\n      'learningRate': this.learningRate,\n      'momentum': this.momentum,\n      'useNesterov': this.useNesterov\n    };\n  }\n\n  /** @nocollapse */\n  static fromConfig<T extends Serializable>(\n    cls: SerializableConstructor<T>,\n    config: ConfigDict): T {\n    return new cls(\n      config['learningRate'], config['momentum'],
config['useNesterov']);\n  }\n}\n\nregisterClass(MomentumOptimizer);\n\n"/**\n * @license\n * Copyright 2018
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====\n
*/\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
../ops/add';\nimport {div} from '../ops/div';\nimport {mul} from '../ops/mul';\nimport {sqrt} from
../ops/sqrt';\nimport {square} from '../ops/square';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from
../ops/zeros_like';\nimport {ConfigDict, registerClass, Serializable, SerializableConstructor} from
../serialization';\nimport {NamedTensor, NamedTensorMap} from '../tensor_types';\nimport {Optimizer,
OptimizerVariable} from '../optimizer';\n\n/** @doclink Optimizer */\nexport class RMSPropOptimizer extends
Optimizer {\n  /** @nocollapse */\n  static className = 'RMSProp'; // Note: Name matters for Python
compatibility.\n  private centered: boolean;\n\n  private accumulatedMeanSquares: OptimizerVariable[] = [];\n  private accumulatedMoments: OptimizerVariable[] = [];\n  private accumulatedMeanGrads: OptimizerVariable[] =
[];\n\n  constructor(\n    protected learningRate: number, protected decay = 0.9,\n    protected momentum = 0.0,\n    protected epsilon: number = null,\n    centered = false) {\n    super();\n\n    this.centered = centered;\n\n    if
(epsilon == null) {\n      this.epsilon = ENGINE.backend.epsilon();\n    }\n\n    if (learningRate == null) {\n      throw
new Error('learningRate for RMSPropOptimizer must be defined.');

```

```

this.accumulatedMoments[i] = {\n      originalName: `${name}/momentum`,\n      variable: tidy(() =>
zerosLike(value).variable(trainable))\n    });\n    }\n    if (this.accumulatedMeanGrads[i] == null &&
this.centered) {\n      this.accumulatedMeanGrads[i] = {\n        originalName: `${name}/mg`,\n        variable:
tidy(() => zerosLike(value).variable(trainable))\n      });\n    }\n\n    const gradient =
Array.isArray(variableGradients) ?\n      variableGradients[i].tensor :\n      variableGradients[name];\n    if
(gradient == null) {\n      return;\n    }\n\n    const accumulatedMeanSquare =
this.accumulatedMeanSquares[i].variable;\n    const accumulatedMoments =
this.accumulatedMoments[i].variable;\n    tidy(() => {\n      const newAccumulatedMeanSquare =\nadd(mul(accumulatedMeanSquare, this.decay),\n      mul(square(gradient), 1 - this.decay));\n      if
(this.centered) {\n        const accumulatedMeanGrad = this.accumulatedMeanGrads[i].variable;\n        // Centered
gradient\n        const newAccumulatedMeanGrad =\n          add(mul(accumulatedMeanGrad, this.decay),\n            mul(gradient, 1 - this.decay));\n        const gradContribution =\n          div(mul(gradient,
this.learningRate),\n            sqrt(\n              sub(newAccumulatedMeanSquare,\n                add(square(newAccumulatedMeanGrad), this.epsilon))));\n        const newAccumulatedMoments =\nadd(mul(accumulatedMoments, this.momentum), gradContribution);\n        accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n        accumulatedMeanGrad.assign(newAccumulatedMeanGrad);\n        accumulatedMoments.assign(newAccumulatedMoments);\n        const newValue = sub(value,\nnewAccumulatedMoments);\n        value.assign(newValue);\n      } else {\n        // Plain gradient\n        const
newAccumulatedMeanSquare =\n          add(mul(accumulatedMeanSquare, this.decay),\n            mul(square(gradient), 1 - this.decay));\n        const newAccumulatedMoments =\nadd(mul(accumulatedMoments, this.momentum),\n          div(mul(gradient, this.learningRate),\n            sqrt(add(newAccumulatedMeanSquare, this.epsilon))));\n        accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n        accumulatedMoments.assign(newAccumulatedMoments);\n        const newValue = sub(value,\nnewAccumulatedMoments);\n        value.assign(newValue);\n      }\n    });\n  }\n  dispose(): void {\n    if (this.accumulatedMeanSquares != null) {\n      dispose(this.accumulatedMeanSquares.map(v => v.variable));\n    }\n    if (this.accumulatedMeanGrads != null &&
this.centered) {\n      dispose(this.accumulatedMeanGrads.map(v => v.variable));\n    }\n    if
(this.accumulatedMoments != null) {\n      dispose(this.accumulatedMoments.map(v => v.variable));\n    }\n  }\n  async getWeights(): Promise<NamedTensor[]> {\n    // Order matters for Python compatibility.\n    const variables:
OptimizerVariable[] =\n      [...this.accumulatedMeanSquares, ...this.accumulatedMoments];\n    if (this.centered)
{\n      variables.push(...this.accumulatedMeanGrads);\n    }\n    return [await this.saveIterations()].concat(\n      variables.map(v => ({name: v.originalName, tensor: v.variable}));\n    );\n  }\n  async setWeights(weightValues:
NamedTensor[]): Promise<void> {\n    weightValues = await this.extractIterations(weightValues);\n    const
variableCount =\n      this.centered ? weightValues.length / 3 : weightValues.length / 2;\n    const trainable =
false;\n    this.accumulatedMeanSquares =\n      weightValues.slice(0, variableCount).map(v => ({\n        originalName: v.name,\n        variable: v.tensor.variable(\n          trainable)\n        }));\n    this.accumulatedMoments =\n      weightValues.slice(variableCount, variableCount * 2).\n        map(v => ({\n          originalName: v.name,\n          variable: v.tensor.variable(trainable)\n        }));\n    if (this.centered) {\n      this.accumulatedMeanGrads =\n        weightValues.slice(variableCount * 2, variableCount * 3).\n          map(v
=> ({\n            originalName: v.name,\n            variable: v.tensor.variable(trainable)\n          }));\n    }\n  }\n  get CONFIG(): ConfigDict {\n    return {\n      'learningRate': this.learningRate,\n      'decay': this.decay,\n      'momentum': this.momentum,\n      'epsilon': this.epsilon,\n      'centered': this.centered\n    };
  }\n  /**\n   * @nocollapse *\n   * static fromConfig<T extends Serializable>(\n     cls: SerializableConstructor<T>, config:
ConfigDict): T {\n     return new cls(\n       config['learningRate'], config['decay'], config['momentum'],\n       config['epsilon'], config['centered']);\n     }\n  }\n  registerClass(RMSPropOptimizer);\n  " , "/*\n * @license\n *

```

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```
=====
import {AdadeltaOptimizer} from './adadelta_optimizer';
import {AdagradOptimizer} from './adagrad_optimizer';
import {AdamOptimizer} from './adam_optimizer';
import {AdamaxOptimizer} from './adamax_optimizer';
import {MomentumOptimizer} from './momentum_optimizer';
import {RMSPropOptimizer} from './rmsprop_optimizer';
import {SGDOptimizer} from './sgd_optimizer';

export class OptimizerConstructors {
  /**
   * Constructs a `tf.SGDOptimizer` that uses stochastic gradient descent.
   *
   * // Fit a quadratic function by learning the coefficients a, b, c.
   * const xs = tf.tensor1d([0, 1, 2, 3]);
   * const ys = tf.tensor1d([1.1, 5.9, 16.8, 33.9]);
   * const a = tf.scalar(Math.random()).variable();
   * const b = tf.scalar(Math.random()).variable();
   * const c = tf.scalar(Math.random()).variable();
   * // y = a * x^2 + b * x + c
   * const f = x => a.mul(x.square()).add(b.mul(x)).add(c);
   * const loss = (pred, label) => pred.sub(label).square().mean();
   * const learningRate = 0.01;
   * const optimizer = tf.train.sgd(learningRate);
   * // Train the model.
   * for (let i = 0; i < 10; i++) {
   *   optimizer.minimize(() => loss(f(xs), ys));
   * }
   * // Make predictions.
   * console.log(`a: ${a.dataSync()}, b: ${b.dataSync()}, c: ${c.dataSync()}`);
   * const preds = f(xs).dataSync();
   * preds.forEach((pred, i) => {
   *   console.log(`x: ${i}, pred: ${pred}`);
   * });
   *
   * @param learningRate The learning rate to use for the SGD algorithm.
   * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}
   *
   * static sgd(learningRate: number): SGDOptimizer {
   *   return new SGDOptimizer(learningRate);
   * }
   *
   * Constructs a `tf.MomentumOptimizer` that uses momentum gradient
   * descent.
   *
   * See
   * [http://proceedings.mlr.press/v28/sutskever13.pdf]
   * http://proceedings.mlr.press/v28/sutskever13.pdf
   *
   * @param learningRate The learning rate to use for the Momentum gradient
   * descent algorithm.
   * @param momentum The momentum to use for the momentum gradient
   * algorithm.
   * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}
   *
   * static momentum(learningRate: number, momentum: number, useNesterov = false):
   * MomentumOptimizer {
   *   return new MomentumOptimizer(learningRate, momentum, useNesterov);
   * }
   *
   * Constructs a `tf.RMSPropOptimizer` that uses RMSProp gradient
   * descent. This implementation uses plain momentum and is not centered
   * version of RMSProp.
   *
   * See
   * [http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf]
   * http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf
   *
   * @param learningRate The learning rate to use for the RMSProp gradient
   * descent algorithm.
   * @param decay The discounting factor for the history/coming gradient.
   * @param momentum The momentum to use for the RMSProp gradient
   * algorithm.
   * @param epsilon Small value to avoid zero denominator.
   * @param centered If true, gradients are normalized by the estimated
   * variance of the gradient.
   * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}
   *
   * static rmsprop(learningRate: number, decay = .9, momentum = 0.0, epsilon:
   * number = null, centered = false): RMSPropOptimizer {
   *   return new RMSPropOptimizer(learningRate, decay, momentum, epsilon,
   * centered);
   * }
   *
   * Constructs a `tf.AdamOptimizer` that uses the Adam algorithm.
   *
   * See
   * [https://arxiv.org/abs/1412.6980](https://arxiv.org/abs/1412.6980)
   *
   * @param learningRate The learning rate to use for the Adam gradient
   * descent algorithm.
   * @param beta1 The exponential decay rate for the 1st moment estimates.
   * @param beta2 The exponential decay rate for the 2nd moment estimates.
   * @param epsilon A small constant for numerical stability.
   * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}
   *
   * static adam(learningRate = 0.001, beta1 = 0.9, beta2 = 0.999, epsilon:
   * number = null): AdamOptimizer {
   *   return new AdamOptimizer(learningRate, beta1, beta2, epsilon);
   * }
   *
   *

```

```

Constructs a `tf.AdadeltaOptimizer` that uses the Adadelta algorithm.\n * See
[https://arxiv.org/abs/1212.5701](https://arxiv.org/abs/1212.5701)\n * @param learningRate The learning rate
to use for the Adadelta gradient\n * descent algorithm.\n * @param rho The learning rate decay over each
update.\n * @param epsilon A constant epsilon used to better condition the grad\n * update.\n * @doc
{heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n */\n static adadelta(learningRate = .001, rho =
.95, epsilon: number = null):\n   AdadeltaOptimizer {\n     return new AdadeltaOptimizer(learningRate, rho,
epsilon);\n   }\n\n /**\n * Constructs a `tf.AdamaxOptimizer` that uses the Adamax algorithm.\n * See
[https://arxiv.org/abs/1412.6980](https://arxiv.org/abs/1412.6980)\n * @param learningRate The learning rate
to use for the Adamax gradient\n * descent algorithm.\n * @param beta1 The exponential decay rate for the 1st
moment estimates.\n * @param beta2 The exponential decay rate for the 2nd moment estimates.\n * @param
epsilon A small constant for numerical stability.\n * @param decay The learning rate decay over each update.\n
*\n * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n */\n static adamax(\n
learningRate = 0.002, beta1 = 0.9, beta2 = 0.999, epsilon: number = null,\n   decay = 0.0): AdamaxOptimizer {\n
return new AdamaxOptimizer(learningRate, beta1, beta2, epsilon, decay);\n }\n\n /**\n * Constructs a
`tf.AdagradOptimizer` that uses the Adagrad algorithm.\n * See\n *
[http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf](\n *
http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf)\n * or\n * [http://ruder.io/optimizing-gradient-
descent/index.html#adagrad](\n * http://ruder.io/optimizing-gradient-descent/index.html#adagrad)\n * @param
learningRate The learning rate to use for the Adagrad gradient\n * descent algorithm.\n * @param
initialAccumulatorValue Starting value for the accumulators, must be\n * positive.\n * @doc {heading:
'Training', subheading: 'Optimizers', namespace: 'train'}\n */\n static adagrad(learningRate: number,
initialAccumulatorValue = 0.1):\n   AdagradOptimizer {\n     return new AdagradOptimizer(learningRate,
initialAccumulatorValue);\n   }\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n// So typings can propagate.\nimport { AdadeltaOptimizer } from './optimizers/adadelta_optimizer';\nimport
{ AdagradOptimizer } from './optimizers/adagrad_optimizer';\nimport { AdamOptimizer } from
 './optimizers/adam_optimizer';\nimport { AdamaxOptimizer } from './optimizers/adamax_optimizer';\nimport
{ MomentumOptimizer } from './optimizers/momentum_optimizer';\nimport { OptimizerConstructors } from
 './optimizers/optimizer_constructors';\nimport { RMSPropOptimizer } from
 './optimizers/rmsprop_optimizer';\nimport { SgDOptimizer } from './optimizers/sgd_optimizer';\n\n// tslint:disable-
next-line:no-unused-expression\n[MomentumOptimizer, SgDOptimizer, AdadeltaOptimizer, AdagradOptimizer,\nRMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];\n\nexport const train = {\n  sgd:\n    OptimizerConstructors.sgd,\n  momentum: OptimizerConstructors.momentum,\n  adadelta:\n    OptimizerConstructors.adadelta,\n  adagrad: OptimizerConstructors.adagrad,\n  rmsprop:\n    OptimizerConstructors.rmsprop,\n  adamax: OptimizerConstructors.adamax,\n  adam:\n    OptimizerConstructors.adam\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nconst delayCallback: Function = (() => {\n  if (typeof requestAnimationFrame !== 'undefined') {\n    return requestAnimationFrame;\n  } else if (typeof setImmediate !== 'undefined') {\n    return setImmediate;\n  }\n  return (f: Function) => f(); // no delays\n})();\n\n/**\n * Returns a promise that resolve when a requestAnimationFrame has completed.\n * On Node.js this uses setImmediate instead of requestAnimationFrame.\n * This is simply a sugar method so that users can do the following:\n * `await tf.nextFrame();`\n * @doc {heading: 'Performance', subheading: 'Timing'}\n *\nfunction nextFrame(): Promise<void> {\n  return new Promise<void>(resolve => delayCallback(() => resolve()));\n}\n\nexport {nextFrame};\n\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport * as util from './util';\n\nexport function assertParamsConsistent(shapes: number[][], axis: number) {\n  const rank = shapes[0].length;\n  shapes.forEach((shape, i) => {\n    util.assert(\n      shape.length === rank,\n      () =>`\n        `Error in concat${rank}D: rank of tensors[${i}] must be the same ` +\n        `as the rank of the rest ($${rank})`);\n  });\n  util.assert(\n    axis >= 0 && axis < rank,\n    () =>`\n        `Error in concat${rank}D: axis must be between 0 and $${rank - 1}`);\n  const firstShape = shapes[0];\n  shapes.forEach((shape, i) => {\n    for (let r = 0; r < rank; r++) {\n      util.assert(\n        (r === axis) || (shape[r] === firstShape[r]),\n        () =>`\n            `Error in concat${rank}D: Shape of tensors[${i}] ($${shape}) ` +\n            `does not match the shape of the rest ($${firstShape}) ` +\n            `along the non-concatenated axis ${i}`);\n    }\n  });\n}\n\nexport function computeOutShape(shapes: number[][], axis: number): number[] {\n  const outputShape = shapes[0].slice();\n  for (let i = 1; i < shapes.length; i++) {\n    outputShape[axis] += shapes[i][axis];\n  }\n  return outputShape;\n}\n\n",/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\n/**\n * Inputs of size above this threshold will be parallelized by calling multiple\n * shader programs.\n *\nimport {nearestDivisor} from './util';\n\nexport const PARALLELIZE_THRESHOLD = 30;\n\nexport interface ReduceInfo {\n  windowSize: number;\n  batchSize: number;\n  inSize: number;\n  outSize: number;\n}\n\nexport function computeOptimalWindowSize(inSize: number): number {\n  if (inSize <= PARALLELIZE_THRESHOLD) {\n    return inSize;\n  }\n  return nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\n// Returns the image center in pixels.\nexport function getImageCenter(\n  center: number|[number, number],\n  imageHeight: number,\n  imageWidth: number): [number, number] {\n  const centerX =\n    imageWidth * (typeof center ===\n      (typeof center === 'number' ? center : center[0]);\n    const centerY =\n      imageHeight * (typeof center ===\n        'number' ? center : center[1]);\n  return [centerX, centerY];\n}\n\n",/**\n * @license\n * Copyright 2018 Google

```

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```
=====\n\n * Gets the new shape of the input Tensor after it's been reshaped\n * to:\n * [blockShape[0], ..., blockShape[M-1], batch / prod(blockShape),\n * inputShape[1], ..., inputShape[N-1]]\n * See step 1: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^next export function getReshaped(\n * inputShape: number[], blockShape: number[], prod: number,\n * batchToSpace = true): number[] {\n * let reshaped: number[] = [];\n * if (batchToSpace) {\n *   reshaped = reshaped.concat(blockShape.slice(0));\n *   reshaped.push(inputShape[0] / prod);\n *   reshaped = reshaped.concat(inputShape.slice(1));\n * } else {\n *   reshaped = reshaped.concat(inputShape[0]);\n *   const spatialLength = blockShape.length;\n *   for (let i = 0; i < spatialLength; ++i) {\n *     reshaped =\n *       reshaped.concat([inputShape[i + 1] / blockShape[i], blockShape[i]]);\n *   }\n *   reshaped = reshaped.concat(inputShape.slice(spatialLength + 1));\n * }\n * return reshaped;\n * }\n\n * Gets the permutation that will transpose the dimensions of the\n * reshaped tensor to shape:\n * [batch / prod(block_shape),inputShape[1], blockShape[0], ..., \n * inputShape[M], blockShape[M-1],inputShape[M+1], ..., inputShape[N-1]]\n * See step 2: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^next export function getPermuted(\n * reshapedRank: number, blockShapeRank: number,\n * batchToSpace = true): number[] {\n * const permuted = [];\n * if (batchToSpace) {\n *   permuted.push(blockShapeRank);\n *   for (let i = blockShapeRank + 1; i < reshapedRank; ++i) {\n *     if (i <= 2 * blockShapeRank) {\n *       permuted.push(i);\n *       permuted.push(i - (blockShapeRank + 1));\n *     } else {\n *       permuted.push(i);\n *     }\n *   } else {\n *     const permutedBeforeBatch = [];\n *     const permutedAfterBatch = [];\n *     for (let i = 1; i < reshapedRank; ++i) {\n *       if (i >= blockShapeRank * 2 + 1 || i % 2 === 1) {\n *         permutedAfterBatch.push(i);\n *       } else {\n *         permutedBeforeBatch.push(i);\n *       }\n *     }\n *     permuted.push(...permutedBeforeBatch);\n *     permuted.push(0);\n *     permuted.push(...permutedAfterBatch);\n *   }\n *   return permuted;\n * }\n\n * Gets the shape of the reshaped and permuted input Tensor before any cropping\n * is applied. The new shape will be:\n * [batch / prod(blockShape),inputShape[1] * blockShape[0], ..., \n * inputShape[M] * blockShape[M-1],inputShape[M+1], ..., inputShape[N-1]]\n * See step 3: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^next export function getReshapedPermuted(\n * inputShape: number[], blockShape: number[], prod: number,\n * batchToSpace = true): number[] {\n * const reshapedPermuted = [];\n * if (batchToSpace) {\n *   reshapedPermuted.push(inputShape[0] / prod);\n * } else {\n *   reshapedPermuted.push(inputShape[0] * prod);\n * }\n * for (let i = 1; i < inputShape.length; ++i) {\n *   if (i <= blockShape.length) {\n *     if (batchToSpace) {\n *       reshapedPermuted.push(blockShape[i - 1] * inputShape[i]);\n *     } else {\n *       reshapedPermuted.push(inputShape[i] / blockShape[i - 1]);\n *     }\n *   } else {\n *     reshapedPermuted.push(inputShape[i]);\n *   }\n * }\n * return reshapedPermuted;\n * }\n\n * Converts the crops argument into the beginning coordinates of a slice\n * operation.\n * ^next export function getSliceBeginCoords(\n * crops: number[][], blockShape: number): number[] {\n * const sliceBeginCoords = [0];\n * for (let i = 0; i < blockShape; ++i) {\n *   sliceBeginCoords.push(crops[i][0]);\n * }\n * return sliceBeginCoords;\n * }\n\n * Converts the crops argument into the size of a slice operation. When\n * combined with getSliceBeginCoords this function allows the reshaped and\n * permuted Tensor to be cropped to its final output shape of:\n * [inputShape[1] * blockShape[0] - crops[0,0] - crops[0,1], ..., \n * inputShape[M] * blockShape[M-1] -crops[M-1,0] -\n * crops[M-1,1],inputShape[M+1], ..., inputShape[N-1]]\n * See step 4: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n * ^next export function getSliceSize(\n * uncroppedShape: number[], crops: number[][], blockShape: number): number[] {\n * const sliceSize = uncroppedShape.slice(0, 1);\n * for (let i = 0; i < blockShape; ++i) {\n *   sliceSize.push(uncroppedShape[i + 1] - crops[i][0] - crops[i][1]);\n * }\n * return sliceSize;\n * }\n\n * @license\n * Copyright 2018 Google LLC. All
```


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```
=====\n*\n\nexport const SELU_SCALEALPHA = 1.7580993408473768599402175208123;\nexport const SELU_SCALE = 1.0507009873554804934193349852946;\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nexport const ERF_P = 0.3275911;\nexport const ERF_A1 = 0.254829592;\nexport const ERF_A2 = -0.284496736;\nexport const ERF_A3 = 1.421413741;\nexport const ERF_A4 = -1.453152027;\nexport const ERF_A5 = 1.061405429;\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {env} from './environment';\nexport function warn(...msg: Array<{}>): void {\n  if (!env().getBool('IS_TEST')) {\n    console.warn(...msg);\n  }\n}\n\nexport function log(...msg: Array<{}>): void {\n  if (!env().getBool('IS_TEST')) {\n    console.log(...msg);\n  }\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {TypedArray} from './types';\n/**\n * Merges real and imaginary Float32Arrays into a single complex Float32Array.\n * The memory layout is interleaved as follows:\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n * complex: [r0, i0, r1, i1, r2, i2]\n * This is the inverse of splitRealAndImagArrays.\n * @param real The real values of the complex tensor values.\n * @param imag The imag values of the complex tensor values.\n * @returns A complex tensor as a Float32Array with merged values.\n */\nexport function mergeRealAndImagArrays(\n  real: Float32Array, imag: Float32Array): Float32Array {\n  if (real.length !== imag.length) {\n    throw new Error(\n      `Cannot merge real and imag arrays of different lengths. real: ` +\n        `${real.length}, imag: ${imag.length}.`);\n  }\n  const result = new Float32Array(real.length * 2);\n  for (let i = 0; i < result.length; i += 2) {\n    result[i] = real[i / 2];\n    result[i + 1] = imag[i / 2];\n  }\n  return result;\n}\n\n/**\n * Splits a complex Float32Array into real and imag parts.\n * The memory layout is interleaved as follows:\n * complex: [r0, i0, r1, i1, r2, i2]\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n * This is the inverse of mergeRealAndImagArrays.\n * @param complex The complex tensor values.\n * @returns An object with real and imag Float32Array components of the complex\n *
```

```

tensor.\n */\nexport function splitRealAndImagArrays(complex: Float32Array):\n  {real: Float32Array, imag:\n  Float32Array} {\n  const real = new Float32Array(complex.length / 2);\n  const imag = new\n  Float32Array(complex.length / 2);\n  for (let i = 0; i < complex.length; i += 2) {\n    real[i / 2] = complex[i];\n    imag[i / 2] = complex[i + 1];\n  }\n  return {real, imag};\n}\n\n/**\n * Extracts even indexed complex values in the\n  given array.\n * @param complex The complex tensor values\n */\nexport function\n  complexWithEvenIndex(complex: Float32Array):\n  {real: Float32Array, imag: Float32Array} {\n  const len =\n  Math.ceil(complex.length / 4);\n  const real = new Float32Array(len);\n  const imag = new Float32Array(len);\n  for\n  (let i = 0; i < complex.length; i += 4) {\n    real[Math.floor(i / 4)] = complex[i];\n    imag[Math.floor(i / 4)] =\n    complex[i + 1];\n  }\n  return {real, imag};\n}\n\n/**\n * Extracts odd indexed comple values in the given array.\n * @param complex The complex tensor values\n */\nexport function\n  complexWithOddIndex(complex:\n  Float32Array):\n  {real: Float32Array, imag: Float32Array} {\n  const len = Math.floor(complex.length / 4);\n  const real = new Float32Array(len);\n  const imag = new Float32Array(len);\n  for (let i = 2; i < complex.length; i\n  += 4) {\n    real[Math.floor(i / 4)] = complex[i];\n    imag[Math.floor(i / 4)] = complex[i + 1];\n  }\n  return {real,\n  imag};\n}\n\n/**\n * Get the map representing a complex value in the given array.\n * @param complex The\n  complex tensor values.\n * @param index An index of the target complex value.\n */\nexport function\n  getComplexWithIndex(\n  complex: Float32Array, index: number): {real: number, imag: number} {\n  const real =\n  complex[index * 2];\n  const imag = complex[index * 2 + 1];\n  return {real, imag};\n}\n\n/**\n * Insert a given\n  complex value into the TypedArray.\n * @param data The array in which the complex value is inserted.\n * @param c The complex value to be inserted.\n * @param index An index of the target complex value.\n */\nexport\n  function\n  assignToTypedArray(\n  data: TypedArray, real: number, imag: number, index: number) {\n  data[index * 2] = real;\n  data[index * 2 + 1] = imag;\n}\n\n/**\n * Make the list of exponent terms used by FFT.\n */\nexport\n  function\n  exponents(\n  n: number, inverse: boolean): {real: Float32Array, imag: Float32Array} {\n  const real =\n  new Float32Array(n / 2);\n  const imag = new Float32Array(n / 2);\n  for (let i = 0; i < Math.ceil(n / 2); i++) {\n    const x = (inverse ? 2 : -2) * Math.PI * (i / n);\n    real[i] = Math.cos(x);\n    imag[i] = Math.sin(x);\n  }\n  return\n  {real, imag};\n}\n\n/**\n * Make the exponent term used by FFT.\n */\nexport\n  function\n  exponent(\n  k: number, n:\n  number, inverse: boolean): {real: number, imag: number} {\n  const x = (inverse ? 2 : -2) * Math.PI * (k / n);\n  const real = Math.cos(x);\n  const imag = Math.sin(x);\n  return {real, imag};\n}\n\n"/**\n * @license\n * Copyright\n  2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n  "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n */\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an\n  "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n */

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=====\n\n*/\nimport {TensorInfo} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {assert} from\n  './util';\n\n/**\n * Prepare the split size array. When the input is a number, the axis is evenly\n * divided among the\n  split size. When the input contains the negative value, the\n * rest of the axis is allocated toward that.\n */\nexport\n  function\n  prepareSplitSize(\n  x: Tensor|TensorInfo, numOrSizeSplits: number[]|number,\n  axis = 0): number[]\n  {\n  let splitSizes = [];\n  if (typeof (numOrSizeSplits) === 'number') {\n    assert(\n      x.shape[axis] %\n      numOrSizeSplits === 0,\n      () => 'Number of splits must evenly divide the axis.);\n    splitSizes =\n      new\n      Array(numOrSizeSplits).fill(x.shape[axis] / numOrSizeSplits);\n  } else {\n    const numOfNegs =\n      numOrSizeSplits.reduce((count, value) => {\n        if (value === -1) {\n          count += 1;\n        }\n        return count;\n      }, 0);\n    assert(\n      numOfNegs <= 1,\n      () => 'There should be only one negative value in split array.);\n    const negIndex = numOrSizeSplits.indexOf(-1);\n    // Allow the number of split array to be -1, which indicates the\n    rest\n    // of dimension is allocated to that split.\n    if (negIndex !== -1) {\n      const total =\n        numOrSizeSplits.reduce((a, b) => b > 0 ? a + b : a);\n      numOrSizeSplits[negIndex] = x.shape[axis] - total;\n    }\n    assert(\n      x.shape[axis] === numOrSizeSplits.reduce((a, b) => a + b),\n      () => 'The sum of sizes must match\n      the size of the axis dimension.);\n    splitSizes = numOrSizeSplits;\n  }\n  return splitSizes;\n}\n\n"/**\n *

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```
=====\n*\n\nimport {TensorInfo} from './kernel_registry';\nimport {nearestDivisor} from './util';\nimport {PARALLELIZE_THRESHOLD} from './reduce_util';\nexport interface SegOpInfo {\n  windowSize: number;\n  batchSize: number;\n  inSize: number;\n  numSegments: number;\n}\nexport function\nsegOpComputeOptimalWindowSize(\n  inSize: number, numSegments: number): number {\n  let done = false;\n  let res;\n  if (inSize <= PARALLELIZE_THRESHOLD) {\n    res = inSize;\n    done = true;\n  } else {\n    res =\n    nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n  }\n  while (!done) {\n    if (res > numSegments || res ===\n    inSize) {\n      done = true;\n    } else {\n      res = nearestDivisor(inSize, res + 1);\n    }\n  }\n  return\n  res;\n}\nexport function computeOutShape(\n  aShape: number[], axis: number, numSegments: number):\n  number[] {\n  const outShape = [];\n  const rank = aShape.length;\n  for (let dim = 0; dim < rank; dim++) {\n    if\n    (dim !== axis) {\n      outShape.push(aShape[dim]);\n    } else {\n      outShape.push(numSegments);\n    }\n  }\n  return outShape;\n}\nexport interface GatherOpShapeInfo {\n  batchSize: number;\n  sliceSize: number;\n  outerSize: number;\n  dimSize: number;\n  outputShape: number[];\n}\nexport function\ncollectGatherOpShapeInfo(\n  x: TensorInfo, indices: TensorInfo, axis: number,\n  batchDims: number):\n  GatherOpShapeInfo {\n  const indicesRank = indices.shape.length;\n  const xRank = x.shape.length;\n  if\n  (batchDims !== 0) {\n    if (batchDims < -indicesRank || batchDims > indicesRank) {\n      throw new Error(`Expect\n      batchDims in the range of [-${indicesRank}, ${\n      indicesRank}], but got ${batchDims}`);\n    }\n  }\n  if\n  (batchDims < 0) {\n    batchDims += indicesRank;\n  }\n  if (batchDims > xRank) {\n    throw new\n    Error(`batchDims (${batchDims}) must be less than rank(x) (\n    ${xRank}).`);\n  }\n  if (axis < batchDims) {\n    throw new Error(`batchDims (${batchDims}) must be less than or equal to axis\n    (${axis}).`);\n  }\n  for (let\n  i = 0; i < batchDims; ++i) {\n    if (x.shape[i] !== indices.shape[i]) {\n      throw new Error(`\n      x.shape[${i}]:\n      ${x.shape[i]} should be equal to indices.shape[${\n      i}]: ${indices.shape[i]}`);\n    }\n  }\n  const dimSize =\n  x.shape[axis];\n  const outputShape: number[] = [];\n  let batchSize = 1;\n  let outerSize = 1;\n  let sliceSize =\n  1;\n  for (let i = 0; i < batchDims; ++i) {\n    outputShape.push(x.shape[i]);\n    batchSize *= x.shape[i];\n  }\n  for\n  (let i = batchDims; i < axis; ++i) {\n    outputShape.push(x.shape[i]);\n    outerSize *= x.shape[i];\n  }\n  for\n  (let i = batchDims; i < indicesRank; ++i) {\n    outputShape.push(indices.shape[i]);\n  }\n  for\n  (let i = axis + 1; i <\n  xRank; ++i) {\n    outputShape.push(x.shape[i]);\n    sliceSize *= x.shape[i];\n  }\n  return {batchSize, sliceSize,\n  outerSize, dimSize, outputShape};\n}\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

=====\n*\n\nimport {decodeString, encodeString} from './util';\n\n// Utilities needed by backend consumers of tf-\n * core.\n * export * from './ops/axis_util';\n * export * from './ops/broadcast_util';\n * export * from\n * './ops/concat_util';\n * export * from './ops/conv_util';\n * export * from './ops/fused_util';\n * export * from\n * './ops/fused_types';\n * export * from './ops/reduce_util';\n * import * as slice_util from './ops/slice_util';\n * export\n * {slice_util};\n * export {BackendValues, TypedArray, upcastType, PixelData} from './types';\n * export\n * {MemoryInfo, TimingInfo} from './engine';\n * export * from './ops/rotate_util';\n * export * from\n * './ops/array_ops_util';\n * export * from './ops/gather_nd_util';\n * export * from './ops/scatter_nd_util';\n * export * from

```
../ops/selu_util';\nextport * from '../ops/fused_util';\nextport * from '../ops/erf_util';\nextport * from '../log';\nextport *
from '../backends/complex_util';\nextport * from '../ops/split_util';\n\nimport * as segment_util from
../ops/segment_util';\nextport {segment_util};\n\nexport function fromUint8ToStringArray(vals: Uint8Array[]) {\n
try {\n // Decode the bytes into string.\n return vals.map(val => decodeString(val));\n } catch (err) {\n throw
new Error(\n `Failed to decode encoded string bytes into utf-8, error: ${err}`);\n }\n}\n\nexport function
fromStringArrayToUint8(strings: string[]) {\n return strings.map(s => encodeString(s));\n}\n\n"/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n\nexport {nonMaxSuppressionV3Impl, nonMaxSuppressionV4Impl, nonMaxSuppressionV5Impl} from
../non_max_suppression_impl';\nextport {whereImpl} from '../where_impl';\n\n"/**\n * @license\n * Copyright 2020
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n\n// base.ts is tfjs-core without auto registration of things like flags,\n// gradients, chained ops or the opHandler.
See base_side_effects.ts for parts\n// tfjs core that are required side effects.\n\n"/**\n * @fileoverview\n * @suppress
{partialAlias} Optimization disabled due to passing the module\n * object into a function below:\n *\n * import *
as ops from '../ops/ops';\n * setOpHandler(ops);\n */\n\n// Serialization.\n\nimport * as io from './io/io';\nimport * as
math from './math';\nimport * as browser from './ops/browser';\nimport * as gather_util from
../ops/gather_nd_util';\nimport * as scatter_util from '../ops/scatter_nd_util';\nimport * as slice_util from
../ops/slice_util';\nimport * as serialization from './serialization';\nimport * as tensor_util from './tensor_util';\nimport
* as test_util from './test_util';\nimport * as util from './util';\nimport {version} from './version';\n\nexport
{InferenceModel, MetaGraph, MetaGraphInfo, ModelPredictConfig, ModelTensorInfo, SavedModelTensorInfo,
SignatureDef, SignatureDefEntry, SignatureDefInfo} from './model_types';\n\n// Optimizers.\n\nexport
{AdadeltaOptimizer} from './optimizers/adadelta_optimizer';\nextport {AdagradOptimizer} from
../optimizers/adagrad_optimizer';\nextport {AdamOptimizer} from './optimizers/adam_optimizer';\nextport
{AdamaxOptimizer} from './optimizers/adamax_optimizer';\nextport {MomentumOptimizer} from
../optimizers/momentum_optimizer';\nextport {Optimizer} from './optimizers/optimizer';\nextport
{RMSPropOptimizer} from './optimizers/rmsprop_optimizer';\nextport {SGDOptimizer} from
../optimizers/sgd_optimizer';\nextport {Scalar, Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D, Tensor5D,
TensorBuffer, Variable} from './tensor';\nextport {GradSaveFunc, NamedTensorMap, TensorContainer,
TensorContainerArray, TensorContainerObject} from './tensor_types';\nextport {BackendValues, DataType,
DataTypeMap, DataValues, NumericDataType, PixelData, Rank, RecursiveArray, ScalarLike, ShapeMap,
sumOutType, TensorLike, TypedArray, upcastType} from './types';\n\nexport * from '../ops/ops';\nextport
{Reduction} from '../ops/loss_ops_utils';\n\nexport * from './train';\nextport * from './globals';\nextport * from
'/kernel_registry';\nextport {customGrad, grad, grads, valueAndGrad, valueAndGrads, variableGrads} from
'/gradients';\n\nexport {TimingInfo, MemoryInfo, ForwardFunc} from './engine';\nextport {Environment, env,
ENV} from './environment';\nextport {Platform} from './platforms/platform';\n\nexport {version as
version_core};\n\n// Top-level method exports.\n\nexport {nextFrame} from './browser_util';\n\n// Second level
exports.\n\nimport * as backend_util from '../backends/backend_util';\nimport * as device_util from
```

```

./device_util';\nexport {\n browser,\n io,\n math,\n serialization,\n test_util,\n util,\n backend_util,\n
tensor_util,\n slice_util,\n gather_util,\n scatter_util,\n device_util\n};\n\nimport * as kernel_impls from
./backends/kernel_impls';\nexport {kernel_impls};\n\n// Backend specific.\nexport {KernelBackend,
BackendTimingInfo, DataMover, DataStorage} from './backends/backend';\n\n// Export all kernel names /
info.\nexport * from './kernel_names';\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Required side effectful code.\nimport './base_side_effects';\n\n// All exports from this package should be in
base.\nexport * from './base';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nconst contexts: {[key: string]: WebGLRenderingContext} = {};\n\nconst WEBGL_ATTRIBUTES:
WebGLContextAttributes = {\n alpha: false,\n antialias: false,\n premultipliedAlpha: false,\n
preserveDrawingBuffer: false,\n depth: false,\n stencil: false,\n failIfMajorPerformanceCaveat: true\n};\n\nexport
function clearWebGLContext(webGLVersion: number) {\n delete contexts[webGLVersion];\n}\n\nexport function
setWebGLContext(\n webGLVersion: number, gl: WebGLRenderingContext) {\n contexts[webGLVersion] =
gl;\n}\n\nexport function getWebGLContext(webGLVersion: number): WebGLRenderingContext {\n if
(!webGLVersion in contexts) {\n const newCtx = getWebGLRenderingContext(webGLVersion);\n if (newCtx
!== null) {\n contexts[webGLVersion] = newCtx;\n } else {\n console.log('Could not get context for
WebGL version', webGLVersion);\n return null;\n }\n }\n const gl = contexts[webGLVersion];\n if
(gl.isContextLost()) {\n delete contexts[webGLVersion];\n return getWebGLContext(webGLVersion);\n }\n\n
gl.disable(gl.DEPTH_TEST);\n gl.disable(gl.STENCIL_TEST);\n gl.disable(gl.BLEND);\n
gl.disable(gl.DITHER);\n gl.disable(gl.POLYGON_OFFSET_FILL);\n gl.disable(gl.SAMPLE_COVERAGE);\n
gl.enable(gl.SCISSOR_TEST);\n gl.enable(gl.CULL_FACE);\n gl.cullFace(gl.BACK);\n\n return
contexts[webGLVersion];\n}\n\nfunction createCanvas(webGLVersion: number) {\n if (typeof OffscreenCanvas
!== 'undefined' && webGLVersion === 2) {\n return new OffscreenCanvas(300, 150);\n } else if (typeof
document !== 'undefined') {\n return document.createElement('canvas');\n } else {\n throw new Error('Cannot
create a canvas in this context');\n }\n}\n\nfunction getWebGLRenderingContext(webGLVersion: number):
WebGLRenderingContext {\n if (webGLVersion !== 1 && webGLVersion !== 2) {\n throw new Error('Cannot
get WebGL rendering context, WebGL is disabled.);\n }\n const canvas = createCanvas(webGLVersion);\n\n
canvas.addEventListener('webglcontextlost', (ev: Event) => {\n ev.preventDefault();\n delete
contexts[webGLVersion];\n }, false);\n if (webGLVersion === 1) {\n return (canvas.getContext('webgl',
WEBGL_ATTRIBUTES) ||\n canvas.getContext('experimental-webgl', WEBGL_ATTRIBUTES)) as\n
WebGLRenderingContext;\n }\n return canvas.getContext('webgl2', WEBGL_ATTRIBUTES) as
WebGLRenderingContext;\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

```

software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {backend_util, DataId, DataType, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nexport enum PackingScheme {\n  /**\n   * All values in a single texel are densely packed without any constraints.\n   *\n   * This is how the shader encodes a tensor with shape = [2, 3, 4]\n   * (indices are [batch, row, col]).\n   *\n   * 000|001 010|011 020|021\n   * -----\n   * 002|003 012|013 022|023\n   *\n   * 100|101 110|111 120|121\n   * -----\n   * 102|103 112|113 122|123\n   *\n   * \n DENSE,\n\n  /**\n   * Single texels contain only values from the same batch, and from adjacent\n   * rows and columns.\n   *\n   * This is how the shader encodes a tensor with shape = [2, 3, 5]\n   * (indices are [batch, row, col]).\n   *\n   * 000|001 002|003 004|xxx 020|021 022|023 024|xxx\n   * -----\n   * 010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n   *\n   * 100|101 102|103 104|xxx 120|121 122|123 124|xxx\n   * -----\n   * 110|111 112|113 114|xxx xxx|xxx xxx|xxx xxx|xxx\n   *\n   * \n SHARED_BATCH\n\n}\n\nexport enum TextureUsage {\n  RENDER,\n  UPLOAD,\n  PIXELS,\n  DOWNLOAD\n}\n\nexport enum PhysicalTextureType {\n  UNPACKED_FLOAT16,\n  UNPACKED_FLOAT32,\n  PACKED_4X1_UNSIGNED_BYTE,\n  PACKED_2X2_FLOAT32,\n  PACKED_2X2_FLOAT16\n}\n\nexport interface TextureData {\n  // Required.\n  shape: number[];\n  dtype: DataType;\n\n  // Optional.\n  values?: backend_util.BackendValues;\n  texture?: WebGLTexture;\n\n  // For complex numbers, the real and imaginary parts are stored as their own\n  // individual tensorInfos, with a parent joining the two with the\n  // complexTensors field. When this is defined, texture will be null.\n  complexTensorInfos?: {real: TensorInfo, imag: TensorInfo};\n\n  /** [rows, columns] shape of the texture. *\n  texShape?: [number, number];\n\n  usage?: TextureUsage;\n  isPacked?: boolean;\n\n  refCount: number;\n\n  // Available when the tensor has been sliced.\n  slice?: {\n    // Offset in the 'flat index' space.\n    flatOffset: number;\n    // Used for counting how many sliced tensors point to the same texture.\n    origDataId: DataId;\n  };\n}\n\nexport function getUnpackedMatrixTextureShapeWidthHeight(\n  rows: number, columns: number): [number, number] {\n  return [columns, rows];\n}\n\nexport function getUnpackedArraySizeFromMatrixSize(\n  matrixSize: number, channelsPerTexture: number): number {\n  return matrixSize * channelsPerTexture;\n}\n\nexport function getColorMatrixTextureShapeWidthHeight(\n  rows: number, columns: number): [number, number] {\n  return [columns * 4, rows];\n}\n\n/**\n * Get shape for densely packed RGBA texture.\n *\n */\nexport function getDenseTexShape(shape: number[]): [number, number] {\n  const size = util.sizeFromShape(shape);\n  const texelsNeeded = Math.ceil(size / 4);\n  return util.sizeToSquarishShape(texelsNeeded);\n}\n\nexport function getMatrixSizeFromUnpackedArraySize(\n  unpackedSize: number, channelsPerTexture: number): number {\n  if (unpackedSize % channelsPerTexture !== 0) {\n    throw new Error(\n      `unpackedSize (${unpackedSize}) must be a multiple of ` +\n      `${channelsPerTexture}`);\n  }\n  return unpackedSize / channelsPerTexture;\n}\n\nexport function decodeMatrixFromUnpackedColorRGBAArray(\n  unpackedArray: Float32Array, matrix: Float32Array, channels: number) {\n  const requiredSize = unpackedArray.length * channels / 4;\n  if (matrix.length < requiredSize) {\n    throw new Error(\n      `matrix length (${matrix.length}) must be >= ${requiredSize}`);\n  }\n  let dst = 0;\n  for (let src = 0; src < unpackedArray.length; src += 4) {\n    for (let c = 0; c < channels; c++) {\n      matrix[dst++] = unpackedArray[src + c];\n    }\n  }\n}\n\nexport function getPackedMatrixTextureShapeWidthHeight(\n  rows: number, columns: number): [number, number] {\n  return [\n    Math.max(1, Math.ceil(columns / 2)), Math.max(1, Math.ceil(rows / 2))\n  ];\n}\n\nexport function getPackedRGBAArraySizeFromMatrixShape(\n  rows: number, columns: number): number {\n  const [w, h] = getPackedMatrixTextureShapeWidthHeight(rows, columns);\n  return w * h * 4;\n}\n\nexport interface TextureConfig {\n  internalFormatFloat: number;\n  textureFormatFloat: number;\n\n  internalFormatPackedHalfFloat: number;\n  internalFormatHalfFloat: number;\n  internalFormatPackedFloat: number;\n\n  // The format to use during a gl.readPixels call.\n  downloadTextureFormat: number;\n\n  // How many channels need to be unpacked after a gl.readPixels call.\n  downloadUnpackNumChannels: number;\n}
```



```

WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(vertexShader, vertexShaderSource));\n
callAndCheck(gl, () => gl.compileShader(vertexShader));\n if (gl.getShaderParameter(vertexShader,\n
gl.COMPILE_STATUS) === false) {\n console.log(gl.getShaderInfoLog(vertexShader));\n throw new\n
Error('Failed to compile vertex shader.);\n }\n return vertexShader;\n}\n\nexport function\n
createFragmentShader(\n gl: WebGLRenderingContext, fragmentShaderSource: string): WebGLShader {\n const\n
fragmentShader: WebGLShader = throwIfNull<WebGLShader>(\n gl, () =>\n
gl.createShader(gl.FRAGMENT_SHADER),\n 'Unable to create fragment WebGLShader.);\n callAndCheck(gl,\n
() => gl.shaderSource(fragmentShader, fragmentShaderSource));\n callAndCheck(gl, () =>\n
gl.compileShader(fragmentShader));\n if (gl.getShaderParameter(fragmentShader, gl.COMPILE_STATUS) ===\n
false) {\n logShaderSourceAndInfoLog(\n fragmentShaderSource, gl.getShaderInfoLog(fragmentShader));\n\n
throw new Error('Failed to compile fragment shader.);\n }\n return fragmentShader;\n}\n\nconst lineNumberRegex\n
= /ERROR: [0-9]+:([0-9]+)/g;\nfunction logShaderSourceAndInfoLog(\n shaderSource: string, shaderInfoLog:\n
string) {\n const lineNumberRegexResult = lineNumberRegex.exec(shaderInfoLog);\n if (lineNumberRegexResult\n
== null) {\n console.log(`Couldn't parse line number in error: ${shaderInfoLog}`);\n\n
console.log(shaderSource);\n return;\n }\n\n const lineNumber = +lineNumberRegexResult[1];\n const\n
shaderLines = shaderSource.split('\n');\n const pad = shaderLines.length.toString().length + 2;\n const\n
linesWithLineNumbers = shaderLines.map(\n (line, lineNumber) =>\n util.rightPad((lineNumber +\n
1).toString(), pad) + line);\n let maxLineLength = 0;\n for (let i = 0; i < linesWithLineNumbers.length; i++) {\n\n
maxLineLength = Math.max(linesWithLineNumbers[i].length, maxLineLength);\n }\n\n const beforeErrorLines =\n
linesWithLineNumbers.slice(0, lineNumber - 1);\n const errorLine = linesWithLineNumbers.slice(lineNumber - 1,\n
lineNumber);\n const afterErrorLines = linesWithLineNumbers.slice(lineNumber);\n\n
console.log(beforeErrorLines.join('\n'));\n console.log(shaderInfoLog.split('\n')[0]);\n console.log(\n `%c\n
${util.rightPad(errorLine[0], maxLineLength)} `,\n 'border: 1px solid red; background-color: #e3d2d2;\n
color: #a61717');\n console.log(afterErrorLines.join('\n'));\n}\n\nexport function createProgram(gl:\n
WebGLRenderingContext): WebGLProgram {\n return throwIfNull<WebGLProgram>(\n gl, () =>\n
gl.createProgram(), 'Unable to create WebGLProgram.);\n}\n\nexport function linkProgram(gl:\n
WebGLRenderingContext, program: WebGLProgram) {\n callAndCheck(gl, () => gl.linkProgram(program));\n if\n
(gl.getProgramParameter(program, gl.LINK_STATUS) === false) {\n\n
console.log(gl.getProgramInfoLog(program));\n throw new Error('Failed to link vertex and fragment shaders.);\n\n
}\n}\n\nexport function validateProgram(\n gl: WebGLRenderingContext, program: WebGLProgram) {\n\n
callAndCheck(gl, () => gl.validateProgram(program));\n if (gl.getProgramParameter(program,\n
gl.VALIDATE_STATUS) === false) {\n console.log(gl.getProgramInfoLog(program));\n throw new\n
Error('Shader program validation failed.);\n }\n}\n\nexport function createStaticVertexBuffer(\n gl:\n
WebGLRenderingContext, data: Float32Array): WebGLBuffer {\n const buffer: WebGLBuffer =\n
throwIfNull<WebGLBuffer>(\n gl, () => gl.createBuffer(), 'Unable to create WebGLBuffer');\n\n
callAndCheck(gl, () => gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n callAndCheck(gl, () =>\n
gl.bufferData(gl.ARRAY_BUFFER, data, gl.STATIC_DRAW));\n return buffer;\n}\n\nexport function\n
createStaticIndexBuffer(\n gl: WebGLRenderingContext, data: Uint16Array): WebGLBuffer {\n const buffer:\n
WebGLBuffer = throwIfNull<WebGLBuffer>(\n gl, () => gl.createBuffer(), 'Unable to create WebGLBuffer');\n\n
callAndCheck(gl, () => gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER, buffer));\n callAndCheck(\n gl, () =>\n
gl.bufferData(gl.ELEMENT_ARRAY_BUFFER, data, gl.STATIC_DRAW));\n return buffer;\n}\n\nexport\n
function getNumChannels(): number {\n if (env().getNumber('WEBGL_VERSION') === 2) {\n return 1;\n }\n\n
return 4;\n}\n\nexport function createTexture(gl: WebGLRenderingContext): WebGLTexture {\n return\n
throwIfNull<WebGLTexture>(\n gl, () => gl.createTexture(), 'Unable to create WebGLTexture.);\n}\n\nexport\n
function validateTextureSize(width: number, height: number) {\n const maxTextureSize =\n
env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n if ((width <= 0) || (height <= 0)) {\n const requested =\n
`${width}x${height}`;\n throw new Error('Requested texture size ' + requested + ' is invalid.);\n }\n if\n
((width > maxTextureSize) || (height > maxTextureSize)) {\n const requested = `${width}x${height}`;\n const max =

```



```

`[${maxTextureSize}x${maxTextureSize}];\n  throw new Error(\n    'Requested texture size ' + requested + '\n
' greater than WebGL maximum on this browser / GPU ' + max + '.');\n }\n}\n\nexport function
createFramebuffer(gl: WebGLRenderingContext): WebGLFramebuffer {\n return
throwIfNull<WebGLFramebuffer>(\n  gl, () => gl.createFramebuffer(), 'Unable to create
WebGLFramebuffer.);\n}\n\nexport function bindVertexBufferToProgramAttribute(\n gl:
WebGLRenderingContext, program: WebGLProgram, attribute: string,\n  buffer: WebGLBuffer,
arrayEntriesPerItem: number, itemStrideInBytes: number,\n  itemOffsetInBytes: number): boolean {\n const loc =
gl.getAttribLocation(program, attribute);\n if (loc === -1) {\n // The GPU compiler decided to strip out this
attribute because it's unused,\n // thus no need to bind.\n  return false;\n }\n callAndCheck(gl, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, buffer));\n callAndCheck(\n  gl,\n  () => gl.vertexAttribPointer(\n
loc, arrayEntriesPerItem, gl.FLOAT, false, itemStrideInBytes,\n    itemOffsetInBytes));\n callAndCheck(gl, ()
=> gl.enableVertexAttribArray(loc));\n return true;\n}\n\nexport function bindTextureUnit(\n gl:
WebGLRenderingContext, texture: WebGLTexture, textureUnit: number) {\n validateTextureUnit(gl,
textureUnit);\n callAndCheck(gl, () => gl.activeTexture(gl.TEXTURE0 + textureUnit));\n callAndCheck(gl, () =>
gl.bindTexture(gl.TEXTURE_2D, texture));\n}\n\nexport function unbindTextureUnit(\n gl:
WebGLRenderingContext, textureUnit: number) {\n validateTextureUnit(gl, textureUnit);\n callAndCheck(gl, ()
=> gl.activeTexture(gl.TEXTURE0 + textureUnit));\n callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,
null));\n}\n\nexport function getProgramUniformLocationOrThrow(\n gl: WebGLRenderingContext, program:
WebGLProgram,\n  uniformName: string): WebGLUniformLocation {\n return
throwIfNull<WebGLUniformLocation>(\n  gl, () => gl.getUniformLocation(program, uniformName),\n
'uniform \'' + uniformName + '\' not present in program.);\n}\n\nexport function getProgramUniformLocation(\n
gl: WebGLRenderingContext, program: WebGLProgram,\n  uniformName: string): WebGLUniformLocation {\n
return gl.getUniformLocation(program, uniformName);\n}\n\nexport function
bindTextureToProgramUniformSampler(\n gl: WebGLRenderingContext, texture: WebGLTexture,\n
uniformSamplerLocation: WebGLUniformLocation, textureUnit: number) {\n callAndCheck(gl, () =>
bindTextureUnit(gl, texture, textureUnit));\n callAndCheck(gl, () => gl.uniform1i(uniformSamplerLocation,
textureUnit));\n}\n\nexport function bindCanvasToFramebuffer(gl: WebGLRenderingContext) {\n
callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n callAndCheck(gl, () => gl.viewport(0, 0,
gl.canvas.width, gl.canvas.height));\n callAndCheck(gl, () => gl.scissor(0, 0, gl.canvas.width,
gl.canvas.height));\n}\n\nexport function bindColorTextureToFramebuffer(\n gl: WebGLRenderingContext,
texture: WebGLTexture,\n  framebuffer: WebGLFramebuffer) {\n callAndCheck(gl, () =>
gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer));\n callAndCheck(\n  gl,\n  () =>
gl.framebufferTexture2D(\n    gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture,
0));\n}\n\nexport function unbindColorTextureFromFramebuffer(\n gl: WebGLRenderingContext, framebuffer:
WebGLFramebuffer) {\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer));\n
callAndCheck(\n  gl,\n  () => gl.framebufferTexture2D(\n    gl.FRAMEBUFFER,
gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, null, 0));\n}\n\nexport function validateFramebuffer(gl:
WebGLRenderingContext) {\n const status = gl.checkFramebufferStatus(gl.FRAMEBUFFER);\n if (status !==
gl.FRAMEBUFFER_COMPLETE) {\n  throw new Error(\n    'Error binding framebuffer: ' +
getFramebufferErrorMessage(gl, status);\n  )\n}\n}\n\nexport function getFramebufferErrorMessage(\n gl:
WebGLRenderingContext, status: number): string {\n switch (status) {\n case
gl.FRAMEBUFFER_INCOMPLETE_ATTACHMENT:\n  return
'FRAMEBUFFER_INCOMPLETE_ATTACHMENT';\n case
gl.FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT:\n  return
'FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT';\n case
gl.FRAMEBUFFER_INCOMPLETE_DIMENSIONS:\n  return
'FRAMEBUFFER_INCOMPLETE_DIMENSIONS';\n case gl.FRAMEBUFFER_UNSUPPORTED:\n  return
'FRAMEBUFFER_UNSUPPORTED';\n default:\n  return `unknown error ${status}`;\n }\n}\n\nfunction

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throwIfNull<T>(\n  gl: WebGLRenderingContext, returnOrNull: () => T | null,\n  failureMessage: string): T {\n
const tOrNull: T|null = callAndCheck(gl, () => returnOrNull());\n if (tOrNull === null) {\n  throw new
Error(failureMessage);\n }\n return tOrNull;\n}\n\nfunction validateTextureUnit(gl: WebGLRenderingContext,
textureUnit: number) {\n  const maxTextureUnit = gl.MAX_COMBINED_TEXTURE_IMAGE_UNITS - 1;\n
const glTextureUnit = textureUnit + gl.TEXTURE0;\n  if (glTextureUnit < gl.TEXTURE0 || glTextureUnit >
maxTextureUnit) {\n    const textureUnitRange = `[gl.TEXTURE0, gl.TEXTURE${maxTextureUnit}]`;\n    throw
new Error(`textureUnit must be in ${textureUnitRange}.`);\n  }\n}\n\nexport function getBatchDim(shape:
number[], dimsToSkip = 2): number {\n  return util.sizeFromShape(shape.slice(0, shape.length -
dimsToSkip));\n}\n\nexport function getRowsCols(shape: number[]): [number, number] {\n  if (shape.length === 0)
{\n    throw Error('Cannot get rows and columns of an empty shape array.);\n  }\n  return [\n    shape.length > 1 ?
shape[shape.length - 2] : 1, shape[shape.length - 1]\n  ];\n}\n\nexport function getShapeAs3D(shape: number[]):
[number, number, number] {\n  let shapeAs3D: [number, number, number] = [1, 1, 1];\n  const isScalar =
shape.length === 0 || (shape.length === 1 && shape[0] === 1);\n  if (!isScalar) {\n    shapeAs3D =\n    [getBatchDim(shape), ...getRowsCols(shape)] as [number, number, number];\n  }\n  return
shapeAs3D;\n}\n\nexport function getTextureShapeFromLogicalShape(\n  logShape: number[], isPacked = false):
[number, number] {\n  let maxTexSize = env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n  if (isPacked) {\n
    maxTexSize = maxTexSize * 2;\n    // This logic ensures we accurately count the number of packed texels
needed\n    // to accommodate the tensor. We can only pack values in the same texel if\n    // they are from adjacent
pairs of rows/cols within the same batch. So if a\n    // tensor has 3 rows, we pretend it has 4 rows in order to account
for the\n    // fact that the texels containing the third row are half empty.\n    logShape = logShape.map(\n      (d, i)
=> i >= logShape.length - 2 ?\n        util.nearestLargerEven(logShape[i]) :\n        logShape[i]);\n    // Packed
texture height is at least 2 (the channel height of a single\n    // texel).\n    if (logShape.length === 1) {\n
logShape = [2, logShape[0]];\n    }\n    // If logical shape is 2, we don't squeeze, since we want to match
physical.\n    if (logShape.length !== 2) {\n      const squeezeResult = util.squeezeShape(logShape);\n      logShape =
squeezeResult.newShape;\n    }\n    let size = util.sizeFromShape(logShape);\n    if (logShape.length <= 1 && size <=
maxTexSize) {\n      return [1, size];\n    } else if (\n      logShape.length === 2 && logShape[0] <= maxTexSize &&\n
logShape[1] <= maxTexSize) {\n      return logShape as [number, number];\n    } else if (\n      logShape.length ===
3 && logShape[0] * logShape[1] <= maxTexSize &&\n      logShape[2] <= maxTexSize) {\n      return [logShape[0]
* logShape[1], logShape[2]];\n    } else if (\n      logShape.length === 3 && logShape[0] <= maxTexSize &&\n
logShape[1] * logShape[2] <= maxTexSize) {\n      return [logShape[0], logShape[1] * logShape[2]];\n    } else if (\n
logShape.length === 4 &&\n      logShape[0] * logShape[1] * logShape[2] <= maxTexSize &&\n      logShape[3]
<= maxTexSize) {\n      return [logShape[0] * logShape[1] * logShape[2], logShape[3]];\n    } else if (\n
logShape.length === 4 && logShape[0] <= maxTexSize &&\n      logShape[1] * logShape[2] * logShape[3] <=
maxTexSize) {\n      return [logShape[0], logShape[1] * logShape[2] * logShape[3]];\n    } else {\n      if (isPacked) {\n
// For packed textures size equals the number of channels required to\n      // accommodate the texture data.
However in order to squarify such that\n      // inner dimensions stay even, we rewrite size to equal the number of\n
// texels. Then in the return statement we rehydrate the squarified\n      // dimensions to channel units.\n      const
batchDim = getBatchDim(logShape);\n      let rows = 2, cols = 2;\n      if (logShape.length) {\n        [rows, cols] =
getRowsCols(logShape);\n      }\n      size = batchDim * (rows / 2) * (cols / 2);\n      return
util.sizeToSquarishShape(size).map(d => d * 2) as [number, number];\n    }\n    return
util.sizeToSquarishShape(size);\n  }\n}\n\nfunction isEven(n: number): boolean {\n  return n % 2 ===
0;\n}\n\n/**\n * This determines whether reshaping a packed texture requires rearranging\n * the data within the
texture, assuming 2x2 packing.\n */\nexport function isReshapeFree(shape1: number[], shape2: number[]): boolean
{\n  shape1 = shape1.slice(-2);\n  shape2 = shape2.slice(-2);\n  if (util.arraysEqual(shape1, shape2)) {\n    return
true;\n  }\n  if (!shape1.length || !shape2.length) { // One of the shapes is a scalar.\n    return true;\n  }\n  if
(shape1[0] === 0 || shape1[1] === 0 || shape2[0] === 0 ||\n    shape2[1] === 0) {\n    return true;\n  }\n  if
(shape1.length !== shape2.length) { // One of the shapes is a vector.\n    const shape1Cols = shape1.slice(-1)[0];\n
const shape2Cols = shape2.slice(-1)[0];\n    if (shape1Cols === shape2Cols) {\n      return true;\n    }\n    if

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(isEven(shape1Cols) && isEven(shape2Cols) && (shape1[0] === 1 || shape2[0] === 1)) {\n  return true;\n
}\n }\n return shape1[1] === shape2[1] && isEven(shape1[0]) && isEven(shape2[0]);\n}\n\n// We cache webgl
params because the environment gets reset between\n// unit tests and we don't want to constantly query the
WebGLContext for\n// MAX_TEXTURE_SIZE.\nlet MAX_TEXTURE_SIZE: number;\nlet
MAX_TEXTURES_IN_SHADER: number;\n\nexport function getWebGLMaxTextureSize(webGLVersion:
number): number {\n  if (MAX_TEXTURE_SIZE === null) {\n    const gl = getWebGLContext(webGLVersion);\n
MAX_TEXTURE_SIZE = gl.getParameter(gl.MAX_TEXTURE_SIZE);\n  }\n  return
MAX_TEXTURE_SIZE;\n}\n\nexport function resetMaxTextureSize() {\n  MAX_TEXTURE_SIZE =
null;\n}\n\nexport function resetMaxTexturesInShader() {\n  MAX_TEXTURES_IN_SHADER = null;\n}\n\nexport
function getMaxTexturesInShader(webGLVersion: number): number {\n  if (MAX_TEXTURES_IN_SHADER ===
null) {\n    const gl = getWebGLContext(webGLVersion);\n    MAX_TEXTURES_IN_SHADER =
gl.getParameter(gl.MAX_TEXTURE_IMAGE_UNITS);\n  }\n  // We cap at 16 to avoid spurious runtime \"memory
exhausted\" error.\n  return Math.min(16, MAX_TEXTURES_IN_SHADER);\n}\n\nexport function
getWebGLDisjointQueryTimerVersion(webGLVersion: number): number {\n  if (webGLVersion === 0) {\n
return 0;\n  }\n\n  let queryTimerVersion: number;\n  const gl = getWebGLContext(webGLVersion);\n  if
(hasExtension(gl, 'EXT_disjoint_timer_query_webgl2') && webGLVersion === 2) {\n    queryTimerVersion =
2;\n  } else if (hasExtension(gl, 'EXT_disjoint_timer_query')) {\n    queryTimerVersion = 1;\n  } else {\n
queryTimerVersion = 0;\n  }\n  return queryTimerVersion;\n}\n\nexport function hasExtension(gl:
WebGLRenderingContext, extensionName: string) {\n  const ext = gl.getExtension(extensionName);\n  return ext !==
null;\n}\n\nexport function isWebGLVersionEnabled(webGLVersion: 1|2) {\n  try {\n    const gl =
getWebGLContext(webGLVersion);\n    if (gl !== null) {\n      return true;\n    }\n  } catch (e) {\n    console.log('Error
when getting WebGL context: ', e);\n    return false;\n  }\n  return false;\n}\n\nexport function
isCapableOfRenderingToFloatTexture(webGLVersion: number): boolean {\n  if (webGLVersion === 0) {\n
return false;\n  }\n\n  const gl = getWebGLContext(webGLVersion);\n  if (webGLVersion === 1) {\n    if
(!hasExtension(gl, 'OES_texture_float')) {\n      return false;\n    }\n  } else {\n    if (!hasExtension(gl,
'EXT_color_buffer_float')) {\n      return false;\n    }\n  }\n\n  const isFramebufferComplete =
createFloatTextureAndBindToFramebuffer(gl);\n  return isFramebufferComplete;\n}\n\n**\n * Check if we can
download values from a float/half-float texture.\n * \n * Note that for performance reasons we use binding a texture
to a framebuffer\n * as a proxy for ability to download float values later using readPixels. The\n * texture params of
this texture will not match those in readPixels exactly\n * but if we are unable to bind some kind of float texture to
the framebuffer\n * then we definitely will not be able to read float values from it.\n */\n\nexport function
isDownloadFloatTextureEnabled(webGLVersion: number): boolean {\n  if (webGLVersion === 0) {\n    return
false;\n  }\n\n  const gl = getWebGLContext(webGLVersion);\n  if (webGLVersion === 1) {\n    if
(!hasExtension(gl, 'OES_texture_float')) {\n      return false;\n    }\n  } else {\n    if (hasExtension(gl,
'WEBGL_color_buffer_float')) {\n      return false;\n    }\n  } else {\n    if (hasExtension(gl,
'EXT_color_buffer_float')) {\n      return createFloatTextureAndBindToFramebuffer(gl);\n    }\n  }\n\n  const
COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n  if (hasExtension(gl,
COLOR_BUFFER_HALF_FLOAT)) {\n    const textureHalfFloatExtension =\n
gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n    return
createHalfFloatTextureAndBindToFramebuffer(\n      gl, textureHalfFloatExtension);\n  }\n\n  return false;\n
}\n\n  const isFramebufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n  return
isFramebufferComplete;\n}\n\nfunction createFloatTextureAndBindToFramebuffer(gl:
WebGLRenderingContext): boolean {\n  const texConfig = getTextureConfig(gl);\n  const texture =
gl.createTexture();\n  gl.bindTexture(gl.TEXTURE_2D, texture);\n  const width = 1;\n  const height = 1;\n
gl.texImage2D(\n    gl.TEXTURE_2D, 0, texConfig.internalFormatFloat, width, height, 0,\n
texConfig.textureFormatFloat, texConfig.textureTypeFloat, null);\n  const framebuffer =
gl.createFramebuffer();\n  gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n  gl.framebufferTexture2D(\n
gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n  const

```



```

'WEBGL_PACK_BINARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack
unary ops. */\nENV.registerFlag(\n  'WEBGL_PACK_UNARY_OPERATIONS', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack array ops. */\nENV.registerFlag(\n
'WEBGL_PACK_ARRAY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack
image ops. */\nENV.registerFlag(\n  'WEBGL_PACK_IMAGE_OPERATIONS', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will pack reduce ops.
*/\nENV.registerFlag('WEBGL_PACK_REDUCE', () => ENV.getBool('WEBGL_PACK'));\n\n/** Whether packed
WebGL kernels lazily unpack their outputs. */\nENV.registerFlag('WEBGL_LAZILY_UNPACK', () =>
ENV.getBool('WEBGL_PACK'));\n\n/** Whether we will use the im2col algorithm to speed up convolutions.
*/\nENV.registerFlag('WEBGL_CONV_IM2COL', () => ENV.getBool('WEBGL_PACK'));\n\n/** The maximum
texture dimension. */\nENV.registerFlag(\n  'WEBGL_MAX_TEXTURE_SIZE', \n  () =>
getWebGLMaxTextureSize(ENV.getNumber('WEBGL_VERSION')));\n\n/** The maximum texture dimension.
*/\nENV.registerFlag(\n  'WEBGL_MAX_TEXTURES_IN_SHADER', \n  () =>
getMaxTexturesInShader(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * The disjoint_query_timer extension
version.\n * 0: disabled, 1: EXT_disjoint_timer_query, 2:\n * EXT_disjoint_timer_query_webgl2.\n * In Firefox
with WebGL 2.0,\n * EXT_disjoint_timer_query_webgl2 is not available, so we must use the\n * WebGL 1.0
extension.\n */\nENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION', () => {\n
const webGLVersion = ENV.getNumber('WEBGL_VERSION');\n\n if (webGLVersion === 0) {\n  return 0;\n
}\n return getWebGLDisjointQueryTimerVersion(webGLVersion);\n});\n\n/**\n * Whether the timer object from
the disjoint_query_timer extension gives\n * timing information that is reliable.\n */\nENV.registerFlag(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE', \n  () =>
ENV.getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0 &&\n
!device_util.isMobile());\n\n/**\n * Whether the device is physically capable of rendering to float32 textures.\n
*/\nENV.registerFlag(\n  'WEBGL_RENDER_FLOAT32_CAPABLE', \n  () =>
isCapableOfRenderingToFloatTexture(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Whether rendering to
float32 textures is enabled. If disabled, renders to\n * float16 textures.\n
*/\nENV.registerFlag('WEBGL_RENDER_FLOAT32_ENABLED', () => {\n return
ENV.getBool('WEBGL_FORCE_F16_TEXTURES') ?\n  false :\n
ENV.getBool('WEBGL_RENDER_FLOAT32_CAPABLE');\n});\n\n/**\n * Whether downloading float textures is
enabled (16 or 32 bit). If disabled,\n * uses IEEE 754 encoding of the float32 values to 4 uint8 when downloading.\n
*/\nENV.registerFlag(\n  'WEBGL_DOWNLOAD_FLOAT_ENABLED', \n  () =>
isDownloadFloatTextureEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/** Whether the fence API is
available. */\nENV.registerFlag(\n  'WEBGL_FENCE_API_ENABLED', \n  () =>
isWebGLFenceEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Tensors with size <= than this will be
uploaded as uniforms, not textures.\n */\nENV.registerFlag('WEBGL_SIZE_UPLOAD_UNIFORM', () => {\n //
Use uniform uploads only when 32bit floats are supported. In\n // 16bit\n // environments there are problems with
comparing a 16bit texture value\n // with a 32bit uniform value.\n const useUniforms =
ENV.getBool('WEBGL_RENDER_FLOAT32_ENABLED');\n return useUniforms ? 4 : 0;\n});\n\n/**\n * If the
total number of bytes allocated on the GPU is greater than this\n * number, we will aggressively delete textures
upon disposal with\n * gl.deleteMatrixTexture, rather than making them available for reuse.\n */\n * Default value -1
indicates that we will never aggressively delete textures.\n */\nENV.registerFlag(\n
'WEBGL_DELETE_TEXTURE_THRESHOLD', \n  () => {\n  return -1;\n },\n  threshold => {\n  if
(threshold < 0 && threshold !== -1) {\n    throw new Error(\n
`WEBGL_DELETE_TEXTURE_THRESHOLD must be -1 (indicating never ` +\n      `delete) or at least 0, but
got ${threshold}.`);\n  }\n });\n\n"},"**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {env} from '@tensorflow/tfjs-core';\nexport type GLSL = {\n  version: string,\n  attribute: string,\n  varyingVs: string,\n  varyingFs: string,\n  texture2D: string,\n  output: string,\n  defineOutput: string,\n  defineSpecialNaN: string,\n  defineSpecialInf: string,\n  defineRound: string\n};\nexport function\ngetGlsIDifferences(): GLSL {\n  let version: string;\n  let attribute: string;\n  let varyingVs: string;\n  let varyingFs: string;\n  let texture2D: string;\n  let output: string;\n  let defineOutput: string;\n  let defineSpecialNaN: string;\n  let defineSpecialInf: string;\n  let defineRound: string;\n  if (env().getNumber('WEBGL_VERSION') === 2) {\n    version = '#version 300 es';\n    attribute = 'in';\n    varyingVs = 'out';\n    varyingFs = 'in';\n    texture2D = 'texture';\n    output = 'outputColor';\n    defineOutput = 'out vec4 outputColor;'\n    // Use custom isnan definition to work\n    // across differences between\n    // implementations on various platforms. While this should happen in ANGLE\n    // we still see differences between android and windows (on chrome) when\n    // using isnan directly.\n    defineSpecialNaN = `\n      bool isnan_custom(float val) {\n        return (val > 0.0 || val < 0.0) ? false : val != 0.0;\n      }\n      bvec4 isnan_custom(vec4 val) {\n        return bvec4(isnan_custom(val.x),\n          isnan_custom(val.y),\n          isnan_custom(val.z), isnan_custom(val.w));\n      }\n      #define isnan(value) isnan_custom(value)\n    `;\n    // In\n    // webgl 2 we do not need to specify a custom isnan so there is no\n    // need for a special INFINITY constant.\n    defineSpecialInf = `;\n    defineRound = `\n      #define round(value) newRound(value)\n      int newRound(float\n        value) {\n          return int(floor(value + 0.5));\n        }\n        ivec4 newRound(vec4 value) {\n          return\n            ivec4(floor(value + vec4(0.5)));\n        }\n        `;\n    } else {\n      version = \";\n      attribute = 'attribute';\n      varyingVs =\n        'varying';\n      varyingFs = 'varying';\n      texture2D = 'texture2D';\n      output = 'gl_FragColor';\n      defineOutput = \";\n      // WebGL1 has no built in isnan so we define one here.\n      defineSpecialNaN = `\n        #define isnan(value)\n        isnan_custom(value)\n        bool isnan_custom(float val) {\n          return (val > 0. || val < 1. || val == 0.) ? false : true;\n        }\n        bvec4 isnan_custom(vec4 val) {\n          return bvec4(isnan(val.x), isnan(val.y), isnan(val.z),\n            isnan(val.w));\n        }\n        `;\n      defineSpecialInf = `\n        uniform float INFINITY;\n        bool isinf(float val) {\n          return abs(val) == INFINITY;\n        }\n        bvec4 isinf(vec4 val) {\n          return equal(abs(val), vec4(INFINITY));\n        }\n        `;\n      defineRound = `\n        int round(float value) {\n          return int(floor(value + 0.5));\n        }\n        ivec4\n        round(vec4 value) {\n          return ivec4(floor(value + vec4(0.5)));\n        }\n        `;\n    }\n  }\n  return {\n    version,\n    attribute,\n    varyingVs,\n    varyingFs,\n    texture2D,\n    output,\n    defineOutput,\n    defineSpecialNaN,\n    defineSpecialInf,\n    defineRound\n  };}\n\"/*\n * @license\n * Copyright 2018 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *  
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {util} from '@tensorflow/tfjs-core';\n\n/*\n * Produces GLSL code that derives logical coordinates\n * from a flat\n * index. The code performs integer division with each stride and decrements\n * the index until the\n * index equals the final dimension coordinate.\n */\nexport function getLogicalCoordinatesFromFlatIndex(\n  coords: string[], shape: number[], index = 'index'): string {\n  const strides = util.computeStrides(shape);\n  return\n    strides\n      .map((stride, i) => {\n        const line1 = `int ${coords[i]} = ${index} / ${stride}`;\n        const line2 = i\n          ===\n          strides.length - 1 ?\n            `int ${coords[i + 1]} = ${index} - ${coords[i]} * ${stride}`\n            :\n            `index --\n              ${coords[i]} * ${stride}`;\n        return `${line1}; ${line2};`;\n      })\n      .join(\";\");\n}\n\nfunction buildVec(x:\n  string[]): string {\n  if (x.length === 1) {\n    return `${x[0]}`;\n  }\n  return\n    `vec${x.length}(${x.join(',')}`;\n}\n\n/*\n * Produces GLSL code that computes the dot product of the input x and\n * y\n * vectors. Handles splitting inputs into increments of vec4s when necessary.\n */\nexport function dotify(x:
```



```

*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\nimport {getDenseTexShape, PackingScheme} from
 './tex_util';\n\nexport class DecodeMatrixPackedProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  userCode: string;\n  packedInputs = true;\n  packedOutput = true;\n  outputShape: [number, number, number];\n  outPackingScheme = PackingScheme.DENSE;\n\n  constructor(outputShape: [number, number, number]) {\n    const texShape = getDenseTexShape(outputShape);\n    const glsl = getGlsIDifferences();\n    this.outputShape =
outputShape;\n\n    this.userCode = `\n      ivec3 outCoordsFromFlatIndex(int index) {\n        ${\n
shader_util.getLogicalCoordinatesFromFlatIndex(\n          ['r', 'c', 'd'], outputShape)\n        }\n        return ivec3(r, c, d);\n
      }\n\n      void main() {\n        ivec2 resTexRC = ivec2(resultUV.yx * \n          vec2(${texShape[0]},
${texShape[1]}));\n        int index = 4 * (resTexRC.x * ${texShape[1]} + resTexRC.y);\n\n        vec4 result =
vec4(0.);\n        for (int i=0; i<4; i++) {\n          int flatIndex = index + i;\n          ivec3 rc =
outCoordsFromFlatIndex(flatIndex);\n          result[i] = getChannel(getA(rc.x, rc.y, rc.z), vec2(rc.y, rc.z));\n
        }\n\n        ${glsl.output} = result;\n      }\n    `;\n  }\n\n  /**\n   * @license\n   * Copyright 2018 Google LLC. All
Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this
file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * \n
http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing,
software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language
governing permissions and\n   * limitations under the License.\n   *

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*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport
class EncodeFloatProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  userCode: string;\n  outputShape: number[];\n  outTexUsage = TextureUsage.DOWNLOAD;\n\n  constructor(outputShape: number[])
{\n    const glsl = getGlsIDifferences();\n    this.outputShape = outputShape;\n    this.userCode = `\n
${ENCODE_FLOAT_SNIPPET}\n\n    void main() {\n      float x = getAAtOutCoords();\n      ${glsl.output} =
encode_float(x);\n    }\n  `;\n  }\n\n  /**\n   * @license\n   * Copyright 2018 Google LLC. All Rights Reserved.\n
   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in
compliance with the License.\n   * You may obtain a copy of the License at\n   * \n
http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing,
software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language
governing permissions and\n   * limitations under the License.\n   *

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*\n\nimport {getGlsIDifferences} from './glsI_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport
class EncodeFloatPackedProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  userCode: string;\n  outputShape: number[];\n  packedInputs = true;\n  packedOutput = false;\n  outTexUsage =
TextureUsage.DOWNLOAD;\n\n  constructor(outputShape: [number, number, number]) {\n    const glsl =
getGlsIDifferences();\n    this.outputShape = outputShape;\n    this.userCode = `\n
${ENCODE_FLOAT_SNIPPET}\n\n    void main() {\n      ivec3 coords = getOutputCoords();\n      float x =
getChannel(getAAtOutCoords(), vec2(coords.y, coords.z));\n      ${glsl.output} = encode_float(x);\n    }\n  `;\n
  }\n\n  /**\n   * @license\n   * Copyright 2018 Google LLC. All Rights Reserved.\n   * Licensed under the Apache
License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n
   * You may obtain a copy of the License at\n   * \n
http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing,
software\n   * distributed under the License is distributed on an "AS IS"
BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the
License for the specific language governing permissions and\n   * limitations under the License.\n   *

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*\n\nimport {getGslIDifferences} from './gsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\n\nexport class EncodeMatrixProgram implements GPGPUProgram {\n
variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(\n   outputShape: [number,
number, number], texShape: [number, number],\n   inputIsUnsignedByte = false) {\n   const gsl =
getGslIDifferences();\n   const [height, width] = texShape;\n   this.outputShape = outputShape;\n\n   let output =
`result`;\n   if (inputIsUnsignedByte) {\n     output = `floor(result * 255. + 0.5)`;\n   }\n\n   this.userCode = `\n
${shader_util.getFlatIndexFrom3D(outputShape)}\n\n   void main() {\n     ivec3 coords =
getOutputCoords();\n\n     int flatIndex = getFlatIndex(coords);\n     int offset = imod(flatIndex, 4);\n\n
flatIndex = idiv(flatIndex, 4, 1.);\n     int r = flatIndex / ${width};\n     int c = imod(flatIndex, ${width});\n
vec2 uv = (vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n     vec4 values = ${gsl.texture2D}(A, uv);\n\n
float result;\n\n     if(offset == 0) {\n       result = values[0];\n     } else if(offset == 1) {\n       result =
values[1];\n     } else if(offset == 2) {\n       result = values[2];\n     } else {\n       result = values[3];\n
}\n\n     ${gsl.output} = vec4(${output}, 0., 0., 0.); \n   }\n }\n\n", /*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {getGslIDifferences} from './gsl_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\n\n/*\n * This is how the shader encodes a tensor with shape = [2, 3,
5]\n * (indices are [batch, row, col]).\n * 000|001 002|003 004|xxx 020|021 022|023 024|xxx\n * -----
----- ----\n * --- ----- ----- \n * 010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n * \n * 100|101 102|103 104|xxx
120|121 122|123 124|xxx\n * ----- ----- ----- ----- \n * \n * 110|111 112|113 114|xxx xxx|xxx
xxx|xxx\n * \n * Single texels contain only values from the same batch, and from adjacent rows\n * and
columns.\n * \n */\n\nexport class EncodeMatrixPackedProgram implements GPGPUProgram {\n
variableNames =
['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput = true;\n\n
constructor(\n   outputShape: [number, number, number], texShape: [number, number],\n   inputIsUnsignedByte
= false) {\n   const gsl = getGslIDifferences();\n   const [height, width] = texShape;\n   this.outputShape =
outputShape;\n\n   let mainLoop = ";\n   let output = 'result';\n   if (inputIsUnsignedByte) {\n     output =
'floor(result * 255. + 0.5)';\n   }\n\n   for (let row = 0; row <= 1; row++) {\n     for (let col = 0; col <= 1; col++) {\n
\n       const channel = row * 2 + col;\n\n       mainLoop += `\n         localCoords = coords;\n         if(localCoords[2] +
${col} < ${outputShape[2]}) {\n           localCoords[2] += ${col};\n           if(localCoords[1] + ${row} <
${outputShape[1]}) {\n             localCoords[1] += ${row};\n\n             flatIndex = getFlatIndex(localCoords);\n
\n             offset = imod(flatIndex, 4);\n\n             flatIndex = idiv(flatIndex, 4, 1.);\n\n             r = flatIndex / ${width};\n
\n             c = imod(flatIndex, ${width});\n\n             uv = (vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n
\n             values = ${gsl.texture2D}(A, uv);\n\n             if(offset == 0) {\n               result[${channel}] = values[0];\n
\n             } else if(offset == 1) {\n               result[${channel}] = values[1];\n\n             } else if(offset == 2) {\n
\n               result[${channel}] = values[2];\n\n             } else {\n               result[${channel}] = values[3];\n\n             }\n
\n           }\n\n         }\n\n       }\n\n     }\n\n   this.userCode = `\n   ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n
void main() {\n     ivec3 coords = getOutputCoords();\n     vec4 result = vec4(0.);\n     int flatIndex, r, c,
offset;\n     ivec3 localCoords;\n     vec2 uv;\n     vec4 values;\n\n     ${mainLoop}\n\n     ${gsl.output} =
${output};\n   }\n }\n\n", /*\n * \n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,

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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nimport {PixelData, TypedArray} from '@tensorflow/tfjs-core';\nimport {getGslsDifferences} from './gsls_version';\nimport * as tex_util from './tex_util';\nimport {TextureConfig} from './tex_util';\nimport * as webgl_util from './webgl_util';\n\nexport function createVertexShader(gl: WebGLRenderingContext): WebGLShader {\n  const gsls = getGslsDifferences();\n  const vertexShaderSource = `${gsls.version}\n  precision\n  highp float;\n  ${gsls.attribute} vec3 clipSpacePos;\n  ${gsls.attribute} vec2 uv;\n  ${gsls.varyingVs} vec2\n  resultUV;\n\n  void main() {\n    gl_Position = vec4(clipSpacePos, 1);\n    resultUV = uv;\n  };\n  return\n  webgl_util.createVertexShader(gl, vertexShaderSource);\n}\n\nexport function createVertexBuffer(gl:\n  WebGLRenderingContext): WebGLBuffer {\n  // [x y z u v] * [upper-left, lower-left, upper-right, lower-right]\n  const vertexArray = new Float32Array([\n    -1, 1, 0, 0, 1, -1, -1, 0, 0, 0, 1, 1, 0, 1, 1, -1, 0, 1, 0]);\n  return\n  webgl_util.createStaticVertexBuffer(gl, vertexArray);\n}\n\nexport function createIndexBuffer(gl:\n  WebGLRenderingContext): WebGLBuffer {\n  // OpenGL (and WebGL) have \"CCW == front\" winding\n  const\n  triangleVertexIndices = new Uint16Array([0, 1, 2, 2, 1, 3]);\n  return webgl_util.createStaticIndexBuffer(gl,\n  triangleVertexIndices);\n}\n\nfunction createAndConfigureTexture(\n  gl: WebGLRenderingContext, width:\n  number, height: number,\n  internalFormat: number, textureFormat: number,\n  textureType: number):\n  WebGLTexture {\n  webgl_util.validateTextureSize(width, height);\n  const texture =\n  webgl_util.createTexture(gl);\n\n  const tex2d = gl.TEXTURE_2D;\n  webgl_util.callAndCheck(gl, () =>\n  gl.bindTexture(tex2d, texture));\n  webgl_util.callAndCheck(\n  gl, () => gl.texParameteri(tex2d,\n  gl.TEXTURE_WRAP_S, gl.CLAMP_TO_EDGE));\n  webgl_util.callAndCheck(\n  gl, () =>\n  gl.texParameteri(tex2d, gl.TEXTURE_WRAP_T, gl.CLAMP_TO_EDGE));\n  webgl_util.callAndCheck(\n  gl, ()\n  => gl.texParameteri(tex2d, gl.TEXTURE_MIN_FILTER, gl.NEAREST));\n  webgl_util.callAndCheck(\n  gl, ()\n  => gl.texParameteri(tex2d, gl.TEXTURE_MAG_FILTER, gl.NEAREST));\n  webgl_util.callAndCheck(\n  gl,\n  () => gl.texImage2D(\n  tex2d, 0, internalFormat, width, height, 0, textureFormat,\n  textureType,\n  null));\n  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n  return\n  texture;\n}\n\nexport function getInternalFormatForFloat32MatrixTexture(\n  textureConfig: TextureConfig) {\n  return textureConfig.internalFormatFloat;\n}\n\nexport function createFloat32MatrixTexture(\n  gl:\n  WebGLRenderingContext, rows: number, columns: number,\n  textureConfig: TextureConfig): WebGLTexture {\n  const [width, height] =\n  tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n  return\n  createAndConfigureTexture(\n  gl, width, height,\n  getInternalFormatForFloat32MatrixTexture(textureConfig),\n  textureConfig.textureFormatFloat,\n  gl.FLOAT);\n}\n\nexport function getInternalFormatForFloat16MatrixTexture(\n  textureConfig: TextureConfig)\n  {\n  return textureConfig.internalFormatHalfFloat;\n}\n\nexport function createFloat16MatrixTexture(\n  gl:\n  WebGLRenderingContext, rows: number, columns: number,\n  textureConfig: TextureConfig): WebGLTexture {\n  const [width, height] =\n  tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n  return\n  createAndConfigureTexture(\n  gl, width, height,\n  getInternalFormatForFloat16MatrixTexture(textureConfig),\n  textureConfig.textureFormatFloat,\n  textureConfig.textureTypeHalfFloat);\n}\n\nexport function getInternalFormatForUnsignedBytesMatrixTexture(\n  textureConfig: TextureConfig) {\n  return textureConfig.downloadTextureFormat;\n}\n\nexport function\n  createUnsignedBytesMatrixTexture(\n  gl: WebGLRenderingContext, rows: number, columns: number,\n  textureConfig: TextureConfig): WebGLTexture {\n  const [width, height] =\n  tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n  return createAndConfigureTexture(\n  gl, width, height,\n  getInternalFormatForUnsignedBytesMatrixTexture(textureConfig), gl.RGBA,\n  gl.UNSIGNED_BYTE);\n}\n\nexport function getInternalFormatForPackedMatrixTexture(\n  textureConfig:\n  TextureConfig) {\n  return textureConfig.internalFormatPackedFloat;\n}\n\nexport function\n  createPackedMatrixTexture(\n  gl: WebGLRenderingContext, rows: number, columns: number,\n  textureConfig:
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TextureConfig): WebGLTexture {\n  const [width, height] =\n
tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n  return createAndConfigureTexture(\n    gl,\n
width, height, getInternalFormatForPackedMatrixTexture(textureConfig),\n    gl.RGBA, gl.FLOAT);\n}\n\n\nexport\n
function getInternalFormatForFloat16PackedMatrixTexture(\n  textureConfig: TextureConfig) {\n  return\n
textureConfig.internalFormatPackedHalfFloat;\n}\n\n\nexport function createFloat16PackedMatrixTexture(\n  gl:\n
WebGLRenderingContext, rows: number, columns: number,\n  textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n    tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n  return\n
createAndConfigureTexture(\n    gl, width, height,\n
getInternalFormatForFloat16PackedMatrixTexture(textureConfig), gl.RGBA,\n
textureConfig.textureTypeHalfFloat);\n}\n\n\nexport function bindVertexProgramAttributeStreams(\n  gl:\n
WebGLRenderingContext, program: WebGLProgram,\n  vertexBuffer: WebGLBuffer): boolean {\n  const\n
posOffset = 0;          // x is the first buffer element\n  const uvOffset = 3 * 4;          // uv comes after [x y z]\n
const stride = (3 * 4) + (2 * 4); // xyz + uv, each entry is 4-byte float.\n  webgl_util.callAndCheck(\n    gl, () =>\n
gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer));\n  const success =\n
webgl_util.bindVertexBufferToProgramAttribute(\n    gl, program, 'clipSpacePos', vertexBuffer, 3, stride,\n
posOffset);\n  return success &&\n    webgl_util.bindVertexBufferToProgramAttribute(\n      gl, program, 'uv',\n
vertexBuffer, 2, stride, uvOffset);\n}\n\n\nexport function uploadDenseMatrixToTexture(\n  gl:\n
WebGLRenderingContext, texture: WebGLTexture, width: number,\n  height: number, data: TypedArray,\n
textureConfig: TextureConfig) {\n  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,\n
texture));\n}\n\n  let dataForUpload: TypedArray, texelDataType: number, internalFormat: number;\n  if (data\n
instanceof Uint8Array) {\n    dataForUpload = new Uint8Array(width * height * 4);\n    texelDataType =\n
gl.UNSIGNED_BYTE;\n    internalFormat = gl.RGBA;\n  } else {\n    dataForUpload = new Float32Array(width *\n
height * 4);\n    texelDataType = gl.FLOAT;\n    internalFormat = textureConfig.internalFormatPackedFloat;\n
}\n\n  dataForUpload.set(data);\n\n  webgl_util.callAndCheck(\n    gl,\n    () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, internalFormat, width, height, 0, gl.RGBA,\n    texelDataType, dataForUpload));\n}\n\n
webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\n\nexport function\n
uploadPixelDataToTexture(\n  gl: WebGLRenderingContext, texture: WebGLTexture,\n  pixels:\n
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n  HTMLVideoElement) {\n  webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n  if ((pixels as PixelData).data\n
instanceof Uint8Array) {\n    webgl_util.callAndCheck(\n      gl,\n      () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, gl.RGBA, pixels.width, pixels.height, 0, gl.RGBA,\n      gl.UNSIGNED_BYTE, (pixels as\n
PixelData).data));\n  } else {\n    webgl_util.callAndCheck(\n      gl,\n      () => gl.texImage2D(\n
gl.TEXTURE_2D, 0, gl.RGBA, gl.RGBA, gl.UNSIGNED_BYTE,\n      pixels as ImageData |\n
HTMLImageElement | HTMLCanvasElement | HTMLVideoElement));\n  }\n}\n\n
webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\n\nexport function\n
createBufferFromOutputTexture(\n  gl2: WebGL2RenderingContext, rows: number, columns: number,\n
textureConfig: TextureConfig): WebGLBuffer {\n  // Create and bind the buffer.\n  const buffer =\n
gl2.createBuffer();\n  webgl_util.callAndCheck(\n    gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER,\n
buffer));\n}\n\n  // Initialize the buffer to the size of the texture in bytes.\n  const bytesPerFloat = 4;\n  const\n
valuesPerTexel = 4;\n  const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;\n}\n\n
webgl_util.callAndCheck(\n  gl2,\n  () => gl2.bufferData(\n    gl2.PIXEL_PACK_BUFFER,\n
bufferSizeBytes, gl2.STREAM_READ));\n}\n\n  // Enqueue a command on the GPU command queue to copy of\n
texture into the\n  // buffer.\n  webgl_util.callAndCheck(\n    gl2, () => gl2.readPixels(0, 0, columns, rows,\n
gl2.RGBA, gl2.FLOAT, 0));\n}\n\n  webgl_util.callAndCheck(\n    gl2, () =>\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));\n}\n\n  return buffer;\n}\n\n\nexport function\n
downloadFloat32MatrixFromBuffer(\n  gl: WebGLRenderingContext, buffer: WebGLBuffer,\n  size: number):\n
Float32Array {\n  const gl2 = gl as WebGL2RenderingContext;\n\n  const downloadTarget = new\n
Float32Array(size);\n\n  gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n}

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gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0, downloadTarget);\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n\n return downloadTarget;\n}\n\nexport function
downloadByteEncodedFloatMatrixFromOutputTexture(\n  gl: WebGLRenderingContext, rows: number, columns:
number,\n  textureConfig: TextureConfig) {\n  const [w, h] =\n  tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n\n  const numChannels = 4;\n  const
downloadTarget = new Uint8Array(\n    tex_util.getUnpackedArraySizeFromMatrixSize(rows * columns,
numChannels));\n\n  webgl_util.callAndCheck(\n    gl,\n    () => gl.readPixels(\n      0, 0, w, h,
textureConfig.downloadTextureFormat, gl.UNSIGNED_BYTE,\n      downloadTarget));\n\n  // By wrapping the
buffer in a Float32Array, we use native browser IEEE 754\n  // decoding of the 4 bytes that back each 32 bit float.\n  return new Float32Array(downloadTarget.buffer);\n}\n\nexport function downloadPackedMatrixFromBuffer(\n
gl: WebGLRenderingContext, buffer: WebGLBuffer, batch: number, rows: number,\n  cols: number,
physicalRows: number, physicalCols: number,\n  textureConfig: TextureConfig): Float32Array {\n  const gl2 = gl
as WebGL2RenderingContext;\n\n  const downloadTarget =\n  new
Float32Array(tex_util.getPackedRGBAArraySizeFromMatrixShape(\n    physicalRows, physicalCols));\n\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n  gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,
downloadTarget);\n  gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n  return downloadTarget;\n}\n\nexport
function downloadMatrixFromPackedOutputTexture(\n  gl: WebGLRenderingContext, physicalRows: number,\n
physicalCols: number): Float32Array {\n  const packedRGBA = new Float32Array(physicalRows * physicalCols *
4);\n  webgl_util.callAndCheck(\n    gl,\n    () => gl.readPixels(\n      0, 0, physicalCols, physicalRows,
gl.RGBA, gl.FLOAT, packedRGBA));\n  return packedRGBA;\n}\n\n", "/*\n * @license\n * Copyright 2017
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {env, PixelData, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {getWebGLContext,
setWebGLContext} from './canvas_util';\n\nimport * as gpgpu_util from './gpgpu_util';\n\nimport * as tex_util from
 './tex_util';\n\nimport {TextureConfig} from './tex_util';\n\nimport {WebGL1DisjointQueryTimerExtension,
WebGL2DisjointQueryTimerExtension} from './webgl_types';\n\nimport * as webgl_util from
 './webgl_util';\n\nexport interface FenceContext {\n  query: WebGLQuery|WebGLSync;\n  isFencePassed():
boolean;\n}\n\nexport class GPGPUContext {\n  gl: WebGLRenderingContext;\n  textureFloatExtension: {};\n
textureHalfFloatExtension: {};\n  colorBufferFloatExtension: {};\n  colorBufferHalfFloatExtension: {};\n
disjointQueryTimerExtension: WebGL2DisjointQueryTimerExtension|\n  WebGL1DisjointQueryTimerExtension;\n  vertexBuffer: WebGLBuffer;\n  indexBuffer: WebGLBuffer;\n
framebuffer: WebGLFramebuffer;\n  outputTexture: WebGLTexture|null = null;\n  program: WebGLProgram|null =
null;\n  private disposed = false;\n  private disjoint: boolean;\n  textureConfig: TextureConfig;\n\n  constructor(gl?:
WebGLRenderingContext) {\n    const glVersion = env().getNumber('WEBGL_VERSION');\n    if (gl != null) {\n
      this.gl = gl;\n      setWebGLContext(glVersion, gl);\n    } else {\n      this.gl = getWebGLContext(glVersion);\n
    }\n    // WebGL 2.0 enables texture floats without an extension.\n    let COLOR_BUFFER_FLOAT =
'WEBGL_color_buffer_float';\n    const COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n    if
(env().getNumber('WEBGL_VERSION') === 1) {\n      const TEXTURE_FLOAT = 'OES_texture_float';\n      const
TEXTURE_HALF_FLOAT = 'OES_texture_half_float';\n      this.textureFloatExtension =\n      webgl_util.getExtensionOrThrow(this.gl, TEXTURE_FLOAT);\n      if (webgl_util.hasExtension(this.gl,
TEXTURE_HALF_FLOAT)) {\n        this.textureHalfFloatExtension =\n      webgl_util.getExtensionOrThrow(this.gl, TEXTURE_HALF_FLOAT);\n      } else if
(env().get('WEBGL_FORCE_F16_TEXTURES')) {\n        throw new Error(\n          'GL context does not support

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half float textures, yet the '+\n      'environment flag WEBGL_FORCE_F16_TEXTURES is set to true.);\n
}\n\n  this.colorBufferFloatExtension = this.gl.getExtension(COLOR_BUFFER_FLOAT);\n  if\n(webgl_util.hasExtension(this.gl, COLOR_BUFFER_HALF_FLOAT)) {\n    this.colorBufferHalfFloatExtension\n=\n    webgl_util.getExtensionOrThrow(this.gl, COLOR_BUFFER_HALF_FLOAT);\n  } else if\n(env().get('WEBGL_FORCE_F16_TEXTURES')) {\n    throw new Error(\n      'GL context does not support\n  color renderable half floats, yet '+\n      'the environment flag WEBGL_FORCE_F16_TEXTURES is set to\n  true.);\n  }\n  } else {\n    COLOR_BUFFER_FLOAT = 'EXT_color_buffer_float';\n    if\n(webgl_util.hasExtension(this.gl, COLOR_BUFFER_FLOAT)) {\n      this.colorBufferFloatExtension =\nthis.gl.getExtension(COLOR_BUFFER_FLOAT);\n    } else if (webgl_util.hasExtension(this.gl,\nCOLOR_BUFFER_HALF_FLOAT)) {\n      this.colorBufferHalfFloatExtension =\nthis.gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n    } else {\n      throw new Error('GL context does not\nsupport color renderable floats');\n    }\n  }\n\n  this.vertexBuffer = gpgpu_util.createVertexBuffer(this.gl);\n  this.indexBuffer = gpgpu_util.createIndexBuffer(this.gl);\n  this.framebuffer =\nwebgl_util.createFramebuffer(this.gl);\n\n  this.textureConfig =\n  tex_util.getTextureConfig(this.gl,\n  this.textureHalfFloatExtension);\n}\n\nprivate get debug(): boolean {\n  return env().getBool('DEBUG');\n}\n\npublic dispose() {\n  if (this.disposed) {\n    return;\n  }\n  if (this.program != null) {\n    console.warn(\n  'Disposing a GPGPUContext that still has a bound WebGLProgram.' +\n    ' This is probably a resource leak,\n  delete the program with '+\n    'GPGPUContext.deleteProgram before disposing.);\n  }\n  if\n(this.outputTexture != null) {\n    console.warn(\n      'Disposing a GPGPUContext that still has a bound output\n  matrix '+\n    'texture. This is probably a resource leak, delete the output '+\n    'matrix texture with\n  GPGPUContext.deleteMatrixTexture before '+\n    'disposing.);\n  }\n  const gl = this.gl;\n  webgl_util.callAndCheck(gl, () => gl.finish());\n  webgl_util.callAndCheck(gl, () =>\ngl.bindFramebuffer(gl.FRAMEBUFFER, null));\n  webgl_util.callAndCheck(gl, () =>\ngl.deleteFramebuffer(this.framebuffer));\n  webgl_util.callAndCheck(gl, () =>\ngl.bindBuffer(gl.ARRAY_BUFFER, null));\n  webgl_util.callAndCheck(\n    gl, () =>\ngl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER, null));\n  webgl_util.callAndCheck(gl, () =>\ngl.deleteBuffer(this.indexBuffer));\n  this.disposed = true;\n}\n\npublic createFloat32MatrixTexture(rows:\nnumber, columns: number):\n  WebGLTexture {\n  this.throwIfDisposed();\n  return\n  gpgpu_util.createFloat32MatrixTexture(\n    this.gl, rows, columns, this.textureConfig);\n}\n\npublic\ncreateFloat16MatrixTexture(rows: number, columns: number):\n  WebGLTexture {\n  this.throwIfDisposed();\n  return gpgpu_util.createFloat16MatrixTexture(\n    this.gl, rows, columns, this.textureConfig);\n}\n\npublic\ncreateUnsignedBytesMatrixTexture(rows: number, columns: number):\n  WebGLTexture {\n  this.throwIfDisposed();\n  return gpgpu_util.createUnsignedBytesMatrixTexture(\n    this.gl, rows, columns,\n  this.textureConfig);\n}\n\npublic uploadPixelDataToTexture(\n  texture: WebGLTexture,\n  pixels:\n  PixelData|ImageData|HTMLImageElement|HTMLCanvasElement) {\n  this.throwIfDisposed();\n  gpgpu_util.uploadPixelDataToTexture(this.gl, texture, pixels);\n}\n\npublic uploadDenseMatrixToTexture(\n  texture: WebGLTexture, width: number, height: number, data: TypedArray) {\n  this.throwIfDisposed();\n  gpgpu_util.uploadDenseMatrixToTexture(\n    this.gl, texture, width, height, data, this.textureConfig);\n}\n\npublic\ncreateFloat16PackedMatrixTexture(rows: number, columns: number):\n  WebGLTexture {\n  this.throwIfDisposed();\n  return gpgpu_util.createFloat16PackedMatrixTexture(\n    this.gl, rows, columns,\n  this.textureConfig);\n}\n\npublic\ncreatePackedMatrixTexture(rows: number, columns: number):\n  WebGLTexture {\n  this.throwIfDisposed();\n  return gpgpu_util.createPackedMatrixTexture(\n    this.gl, rows,\n  columns, this.textureConfig);\n}\n\npublic deleteMatrixTexture(texture: WebGLTexture) {\n  this.throwIfDisposed();\n  if (this.outputTexture === texture) {\n    webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n    this.outputTexture = null;\n  }\n  webgl_util.callAndCheck(this.gl, () => this.gl.deleteTexture(texture));\n}\n\npublic\ndownloadByteEncodedFloatMatrixFromOutputTexture(\n  texture: WebGLTexture, rows: number, columns:\n  number): Float32Array {\n  return this.downloadMatrixDriver(\n    texture,\n    () =>

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gpgpu_util.downloadByteEncodedFloatMatrixFromOutputTexture(\n      this.gl, rows, columns,
this.textureConfig));\n }\n\n public downloadPackedMatrixFromBuffer(\n      buffer: WebGLBuffer, batch:
number, rows: number, columns: number,\n      physicalRows: number, physicalCols: number): Float32Array {\n
return gpgpu_util.downloadPackedMatrixFromBuffer(\n      this.gl, buffer, batch, rows, columns, physicalRows,
physicalCols,\n      this.textureConfig);\n }\n\n public downloadFloat32MatrixFromBuffer(buffer: WebGLBuffer,
size: number):\n      Float32Array {\n      return gpgpu_util.downloadFloat32MatrixFromBuffer(this.gl, buffer,
size);\n }\n\n public createBufferFromTexture(\n      texture: WebGLTexture, rows: number, columns: number):
WebGLBuffer {\n      this.bindTextureToFramebuffer(texture);\n      const result =
gpgpu_util.createBufferFromOutputTexture(\n      this.gl as WebGL2RenderingContext, rows, columns,
this.textureConfig);\n      this.unbindTextureToFramebuffer();\n      return result;\n }\n\n public
createAndWaitForFence(): Promise<void> {\n      const fenceContext = this.createFence(this.gl);\n      return
this.pollFence(fenceContext);\n }\n\n private createFence(gl: WebGLRenderingContext): FenceContext {\n      let
query: WebGLQuery|WebGLSync;\n      let isFencePassed: () => boolean;\n\n      if
(env().getBool('WEBGL_FENCE_API_ENABLED')) {\n      const gl2 = gl as WebGL2RenderingContext;\n\n      const sync = gl2.fenceSync(gl2.SYNC_GPU_COMMANDS_COMPLETE, 0);\n      gl.flush();\n\n      isFencePassed = () => {\n      const status = gl2.clientWaitSync(sync, 0, 0);\n      return status ===
gl2.ALREADY_SIGNALED ||\n      status === gl2.CONDITION_SATISFIED;\n      };\n\n      query = sync;\n
} else if (\n      env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0) {\n
query = this.beginQuery();\n      this.endQuery();\n      isFencePassed = () => this.isQueryAvailable(\n      query,\n      env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n      } else {\n      // If
we have no way to fence, return true immediately. This will fire in\n      // WebGL 1.0 when there is no disjoint
query timer. In this case, because\n      // the fence passes immediately, we'll immediately ask for a download of\n
// the texture, which will cause the UI thread to hang.\n      isFencePassed = () => true;\n      }\n\n      return {query,
isFencePassed};\n }\n\n public downloadMatrixFromPackedTexture(\n      texture: WebGLTexture, physicalRows:
number,\n      physicalCols: number): Float32Array {\n      return this.downloadMatrixDriver(\n      texture,\n      ()
=> gpgpu_util.downloadMatrixFromPackedOutputTexture(\n      this.gl, physicalRows, physicalCols));\n }\n\n private
vertexAttrsAreBound = false;\n\n public createProgram(fragmentShaderSource: string): WebGLProgram
{\n      this.throwIfDisposed();\n      const gl = this.gl;\n      const fragmentShader: WebGLShader =\n
webgl_util.createFragmentShader(gl, fragmentShaderSource);\n      const vertexShader: WebGLShader =
gpgpu_util.createVertexShader(gl);\n      const program: WebGLProgram = webgl_util.createProgram(gl);\n
webgl_util.callAndCheck(gl, () => gl.attachShader(program, vertexShader));\n      webgl_util.callAndCheck(gl, () =>
gl.attachShader(program, fragmentShader));\n      webgl_util.linkProgram(gl, program);\n      if (this.debug) {\n
webgl_util.validateProgram(gl, program);\n      }\n      if (!this.vertexAttrsAreBound) {\n
this.setProgram(program);\n      this.vertexAttrsAreBound = gpgpu_util.bindVertexProgramAttributeStreams(\n
gl, this.program, this.vertexBuffer);\n      }\n      return program;\n }\n\n public deleteProgram(program:
WebGLProgram) {\n      this.throwIfDisposed();\n      if (program === this.program) {\n      this.program = null;\n
}\n      if (program != null) {\n      webgl_util.callAndCheck(this.gl, () => this.gl.deleteProgram(program));\n      }\n
}\n\n public setProgram(program: WebGLProgram|null) {\n      this.throwIfDisposed();\n      this.program =
program;\n      if ((this.program != null) && this.debug) {\n      webgl_util.validateProgram(this.gl, this.program);\n
}\n      webgl_util.callAndCheck(this.gl, () => this.gl.useProgram(program));\n      }\n\n public getUniformLocation(\n
program: WebGLProgram, uniformName: string,\n      shouldThrow = true): WebGLUniformLocation {\n
this.throwIfDisposed();\n      if (shouldThrow) {\n      return webgl_util.getProgramUniformLocationOrThrow(\n
this.gl, program, uniformName);\n      } else {\n      return webgl_util.getProgramUniformLocation(\n      this.gl,
program, uniformName);\n      }\n      }\n\n public getAttributeLocation(program: WebGLProgram, attribute: string):
number {\n      this.throwIfDisposed();\n      return webgl_util.callAndCheck(\n      this.gl, () =>
this.gl.getAttribLocation(program, attribute));\n      }\n\n public getUniformLocationNoThrow(program:
WebGLProgram, uniformName: string):
WebGLUniformLocation {\n      this.throwIfDisposed();\n      return
this.gl.getUniformLocation(program, uniformName);\n      }\n\n public setInputMatrixTexture(\n

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inputMatrixTexture: WebGLTexture, uniformLocation: WebGLUniformLocation, textureUnit: number) {\n
this.throwIfDisposed();\n this.throwIfNoProgram();\n webgl_util.bindTextureToProgramUniformSampler(\n
this.gl, inputMatrixTexture, uniformLocation, textureUnit);\n }\n\n public setOutputMatrixTexture(\n
outputMatrixTexture: WebGLTexture, rows: number, columns: number) {\n
this.setOutputMatrixTextureDriver(outputMatrixTexture, columns, rows);\n }\n\n public
setOutputPackedMatrixTexture(\n outputPackedMatrixTexture: WebGLTexture, rows: number, columns:
number) {\n this.throwIfDisposed();\n const [width, height] =\n
tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n
this.setOutputMatrixTextureDriver(outputPackedMatrixTexture, width, height);\n }\n\n public
setOutputMatrixWriteRegion(\n startRow: number, numRows: number, startColumn: number,\n
numColumns: number) {\n this.setOutputMatrixWriteRegionDriver(\n startColumn, startRow, numColumns,
numRows);\n }\n\n public setOutputPackedMatrixWriteRegion(\n startRow: number, numRows: number,
startColumn: number,\n numColumns: number) {\n throw new Error('setOutputPackedMatrixWriteRegion not
implemented.);\n }\n\n public debugValidate() {\n if (this.program != null) {\n
webgl_util.validateProgram(this.gl, this.program);\n }\n webgl_util.validateFramebuffer(this.gl);\n }\n\n public
executeProgram() {\n this.throwIfDisposed();\n this.throwIfNoProgram();\n const gl = this.gl;\n if
(this.debug) {\n this.debugValidate();\n }\n webgl_util.callAndCheck(\n gl, () =>
gl.drawElements(gl.TRIANGLES, 6, gl.UNSIGNED_SHORT, 0));\n }\n\n public
blockUntilAllProgramsCompleted() {\n this.throwIfDisposed();\n webgl_util.callAndCheck(this.gl, () =>
this.gl.finish());\n }\n\n private getQueryTimerExtension(): WebGL1DisjointQueryTimerExtension\n
|WebGL2DisjointQueryTimerExtension {\n if (this.disjointQueryTimerExtension == null) {\n
this.disjointQueryTimerExtension =\n webgl_util.getExtensionOrThrow(\n this.gl,\n
env().getNumber(\n 'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2 ?\n
'EXT_disjoint_timer_query_webgl2':\n 'EXT_disjoint_timer_query') as\n
WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension;\n }\n return
this.disjointQueryTimerExtension;\n }\n\n private getQueryTimerExtensionWebGL2():
WebGL2DisjointQueryTimerExtension {\n return this.getQueryTimerExtension();\n }\n\n private
getQueryTimerExtensionWebGL1(): WebGL1DisjointQueryTimerExtension {\n return
this.getQueryTimerExtension() as WebGL1DisjointQueryTimerExtension;\n }\n\n beginQuery(): WebGLQuery
{\n if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2) {\n const
gl2 = this.gl as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n const
query = gl2.createQuery();\n gl2.beginQuery(ext.TIME_ELAPSED_EXT, query);\n return query;\n }\n
const ext = this.getQueryTimerExtensionWebGL1();\n const query = ext.createQueryEXT() as WebGLQuery;\n
ext.beginQueryEXT(ext.TIME_ELAPSED_EXT, query);\n return query;\n }\n\n endQuery() {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2) {\n const gl2 =
this.gl as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n
gl2.endQuery(ext.TIME_ELAPSED_EXT);\n return;\n }\n const ext =
this.getQueryTimerExtensionWebGL1();\n ext.endQueryEXT(ext.TIME_ELAPSED_EXT);\n }\n\n public async
waitForQueryAndGetTime(query: WebGLQuery): Promise<number> {\n await util.repeatedTry(\n () =>
this.disposed || // while testing contexts are created / disposed\n // in rapid succession, so without
this check we\n // may poll for the query timer indefinitely\n this.isQueryAvailable(\n
query,\n env().getNumber(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')));\n return this.getQueryTime(\n query,\n
env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n }\n\n private
getQueryTime(query: WebGLQuery, queryTimerVersion: number): number {\n if (queryTimerVersion === 0) {\n
return null;\n }\n\n if (queryTimerVersion === 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n
const timeElapsedNanos = gl2.getQueryParameter(query, gl2.QUERY_RESULT);\n // Return milliseconds.\n
return timeElapsedNanos / 1000000;\n } else {\n const ext = this.getQueryTimerExtensionWebGL1();\n

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const timeElapsedNanos =\n      ext.getQueryObjectEXT(query, ext.QUERY_RESULT_EXT);\n // Return milliseconds.\n return timeElapsedNanos / 1000000;\n }\n }\n\n private isQueryAvailable(query: WebGLQuery, queryTimerVersion: number):\n boolean {\n if (queryTimerVersion === 0) {\n return true;\n }\n\n if (queryTimerVersion === 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n\n const available =\n gl2.getQueryParameter(query, gl2.QUERY_RESULT_AVAILABLE);\n if (this.disjoint == null) {\n this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n\n return available && !this.disjoint;\n } else {\n const ext = this.getQueryTimerExtensionWebGL1();\n\n const available =\n ext.getQueryObjectEXT(query, ext.QUERY_RESULT_AVAILABLE_EXT);\n if (this.disjoint == null) {\n this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n\n return available && !this.disjoint;\n }\n }\n\n pollFence(fenceContext: FenceContext) {\n return new Promise<void>(resolve => {\n this.addItemToPoll(() => fenceContext.isFencePassed(), () => resolve());\n });\n }\n\n private itemsToPoll: PollItem[] = [];\n pollItems(): void {\n // Find the last query that has finished.\n const index = linearSearchLastTrue(this.itemsToPoll.map(x => x.isDoneFn));\n for (let i = 0; i <= index; ++i) {\n const {resolveFn} = this.itemsToPoll[i];\n resolveFn();\n }\n this.itemsToPoll = this.itemsToPoll.slice(index + 1);\n }\n\n private addItemToPoll(isDoneFn: () => boolean, resolveFn: () => void) {\n this.itemsToPoll.push({isDoneFn, resolveFn});\n if (this.itemsToPoll.length > 1) {\n // We already have a running loop that polls.\n return;\n }\n // Start a new loop that polls.\n util.repeatedTry(() => {\n this.pollItems();\n // End the loop if no more items to poll.\n return this.itemsToPoll.length === 0;\n });\n }\n\n private bindTextureToFramebuffer(texture: WebGLTexture) {\n this.throwIfDisposed();\n webgl_util.bindColorTextureToFramebuffer(\n this.gl, texture, this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(this.gl);\n }\n }\n\n private unbindTextureToFramebuffer() {\n if (this.outputTexture != null) {\n webgl_util.bindColorTextureToFramebuffer(\n this.gl, this.outputTexture, this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(this.gl);\n }\n } else {\n webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n }\n }\n\n private downloadMatrixDriver(\n texture: WebGLTexture,\n downloadAndDecode: () => Float32Array): Float32Array {\n this.bindTextureToFramebuffer(texture);\n const result = downloadAndDecode();\n this.unbindTextureToFramebuffer();\n return result;\n }\n\n private setOutputMatrixTextureDriver(\n outputMatrixTextureMaybePacked: WebGLTexture, width: number,\n height: number) {\n this.throwIfDisposed();\n const gl = this.gl;\n webgl_util.bindColorTextureToFramebuffer(\n gl, outputMatrixTextureMaybePacked, this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(gl);\n }\n this.outputTexture = outputMatrixTextureMaybePacked;\n webgl_util.callAndCheck(gl, () => gl.viewport(0, 0, width, height));\n webgl_util.callAndCheck(gl, () => gl.scissor(0, 0, width, height));\n }\n\n private setOutputMatrixWriteRegionDriver(\n x: number, y: number, width: number, height: number) {\n this.throwIfDisposed();\n webgl_util.callAndCheck(\n this.gl, () => this.gl.scissor(x, y, width, height));\n }\n\n private throwIfDisposed() {\n if (this.disposed) {\n throw new Error('Attempted to use disposed GPGPUContext.);\n }\n }\n\n private throwIfNoProgram() {\n if (this.program == null) {\n throw new Error('No GPU program is currently set.);\n }\n }\n }\n\n type PollItem = {\n isDoneFn: () => boolean,\n resolveFn: () => void\n};\n\n /**\n * Finds the index of the last true element using linear search.\n * Note: We can't do binary search because Chrome expects us to explicitly\n * test all fences before download.\n * https://github.com/tensorflow/tfjs/issues/1145\n */\n export function linearSearchLastTrue(arr: Array<() => boolean>): number {\n let i = 0;\n for (; i < arr.length; ++i) {\n const isDone = arr[i];\n if (!isDone) {\n break;\n }\n }\n return i - 1;\n }\n\n /**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\nconst {getBroadcastDims} = backend_util;\nimport {getGlsIDifferences, GLSL} from './glsl_version';\nimport * as shader_util from './shader_compiler_util';\n\nexport type ShapeInfo = {\n  logicalShape: number[],\n  texShape: [number, number],\n  isUniform: boolean,\n  isPacked: boolean,\n  flatOffset: number\n};\n\nexport type InputInfo = {\n  name: string,\n  shapeInfo: ShapeInfo\n};\n\nexport function makeShader(\n  inputsInfo: InputInfo[], outputShape: ShapeInfo, userCode: string,\n  usesPackedTextures: boolean): string {\n  const prefixSnippets: string[] = [];\n  inputsInfo.forEach(x => {\n    const size = util.sizeFromShape(x.shapeInfo.logicalShape);\n    // Snippet when we decided to upload the values as uniform.\n    if (x.shapeInfo.isUniform) {\n      prefixSnippets.push(`uniform float ${x.name}${size > 1 ? ` [${size}]` : ``};`);\n    } else {\n      prefixSnippets.push(`uniform sampler2D ${x.name};`);\n      prefixSnippets.push(`uniform int offset${x.name};`);\n    }\n  });\n  const inputPrefixSnippet = prefixSnippets.join(`\\n`);\n  const inputSamplingSnippet = inputsInfo.map(x => getInputSamplingSnippet(x, outputShape, usesPackedTextures)).join(`\\n`);\n  const outTexShape = outputShape.texShape;\n  const glsl = getGlsIDifferences();\n  const floatTextureSampleSnippet = getFloatTextureSampleSnippet(glsl);\n  let outputSamplingSnippet: string;\n  let floatTextureSetOutputSnippet: string;\n  let shaderPrefix = getShaderPrefix(glsl);\n  if (outputShape.isPacked) {\n    outputSamplingSnippet = getPackedOutputSamplingSnippet(outputShape.logicalShape, outTexShape);\n    floatTextureSetOutputSnippet = getFloatTextureSetRGBASnippet(glsl);\n  } else {\n    outputSamplingSnippet = getOutputSamplingSnippet(outputShape.logicalShape, outTexShape);\n    floatTextureSetOutputSnippet = getFloatTextureSetRSnippet(glsl);\n  }\n  if (usesPackedTextures) {\n    shaderPrefix += SHADER_PACKED_PREFIX;\n  }\n  const source = [\n    shaderPrefix, floatTextureSampleSnippet, floatTextureSetOutputSnippet, inputPrefixSnippet, outputSamplingSnippet, inputSamplingSnippet, userCode\n  ].join(`\\n`);\n  return source;\n}\n\nfunction getSamplerFromInInfo(inInfo: InputInfo): string {\n  const shape = inInfo.shapeInfo.logicalShape;\n  switch (shape.length) {\n    case 0:\n      return getSamplerScalar(inInfo);\n    case 1:\n      return getSampler1D(inInfo);\n    case 2:\n      return getSampler2D(inInfo);\n    case 3:\n      return getSampler3D(inInfo);\n    case 4:\n      return getSampler4D(inInfo);\n    case 5:\n      return getSampler5D(inInfo);\n    case 6:\n      return getSampler6D(inInfo);\n    default:\n      throw new Error(`\n    ${shape.length}-D input sampling` + ` is not yet supported`);\n  }\n}\n\nfunction getPackedSamplerFromInInfo(inInfo: InputInfo): string {\n  const shape = inInfo.shapeInfo.logicalShape;\n  switch (shape.length) {\n    case 0:\n      return getPackedSamplerScalar(inInfo);\n    case 1:\n      return getPackedSampler1D(inInfo);\n    case 2:\n      return getPackedSampler2D(inInfo);\n    case 3:\n      return getPackedSampler3D(inInfo);\n    default:\n      return getPackedSamplerND(inInfo);\n  }\n}\n\nfunction getInputSamplingSnippet(\n  inInfo: InputInfo, outShapeInfo: ShapeInfo, usesPackedTextures = false): string {\n  let res = ``;\n  if (usesPackedTextures) {\n    res += getPackedSamplerFromInInfo(inInfo);\n  } else {\n    res += getSamplerFromInInfo(inInfo);\n  }\n  const inShape = inInfo.shapeInfo.logicalShape;\n  const outShape = outShapeInfo.logicalShape;\n  if (inShape.length <= outShape.length) {\n    if (usesPackedTextures) {\n      res += getPackedSamplerAtOutputCoords(inInfo, outShapeInfo);\n    } else {\n      res += getSamplerAtOutputCoords(inInfo, outShapeInfo);\n    }\n  }\n  return res;\n}\n\nfunction getPackedOutputSamplingSnippet(\n  outShape: number[], outTexShape: [number, number]): string {\n  switch (outShape.length) {\n    case 0:\n      return getOutputScalarCoords();\n    case 1:\n      return getOutputPacked1DCoords(outShape as [number], outTexShape);\n    case 2:\n      return getOutputPacked2DCoords(outShape as [number, number], outTexShape);\n    case 3:\n      return getOutputPacked3DCoords(outShape as [number, number, number], outTexShape);\n    default:\n      return getOutputPackedNDCoords(outShape, outTexShape);\n  }\n}\n\nfunction getOutputSamplingSnippet(\n  outShape: number[], outTexShape: [number, number]): string {\n  switch (outShape.length) {\n    case 0:\n      return getOutputScalarCoords();\n    case 1:\n      return getOutput1DCoords(outShape as [number], outTexShape);\n    case 2:\n      return getOutput2DCoords(outShape as [number, number], outTexShape);\n    case 3:\n      return
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getOutput3DCoords(\n      outShape as [number, number, number], outTexShape);\n case 4:\n return
getOutput4DCoords(\n      outShape as [number, number, number, number], outTexShape);\n case 5:\n return
getOutput5DCoords(\n      outShape as [number, number, number, number, number], outTexShape);\n case 6:\n
return getOutput6DCoords(\n      outShape as [number, number, number, number, number, number],\n
outTexShape);\n default:\n throw new Error(\n      `${outShape.length}-D output sampling is not yet
supported`);\n }\n}\n\nfunction getFloatTextureSampleSnippet(gsl: GLSL): string {\n return \n float
sampleTexture(sampler2D textureSampler, vec2 uv) {\n return ${gsl.texture2D}(textureSampler, uv).r;\n }\n
};\n}\n\nfunction getFloatTextureSetRSnippet(gsl: GLSL): string {\n return \n void setOutput(float val) {\n
${gsl.output} = vec4(val, 0, 0, 0);\n }\n `;\n}\n\nfunction getFloatTextureSetRGBASnippet(gsl: GLSL): string
{\n return \n void setOutput(vec4 val) {\n ${gsl.output} = val;\n }\n `;\n}\n\nfunction getShaderPrefix(gsl:
GLSL): string {\n const SHADER_PREFIX = `${gsl.version}\n precision highp float;\n precision highp int;\n
precision highp sampler2D;\n ${gsl.varyingFs} vec2 resultUV;\n ${gsl.defineOutput}\n const vec2 halfCR =
vec2(0.5, 0.5);\n\n struct ivec5\n {\n int x;\n int y;\n int z;\n int w;\n int u;\n };\n\n struct
ivec6\n {\n int x;\n int y;\n int z;\n int w;\n int u;\n int v;\n };\n\n uniform float NAN;\n
${gsl.defineSpecialNaN}\n ${gsl.defineSpecialInf}\n ${gsl.defineRound}\n\n int imod(int x, int y) {\n
return x - y * (x / y);\n }\n\n int idiv(int a, int b, float sign) {\n int res = a / b;\n int mod = imod(a, b);\n
if (sign < 0. && mod != 0) {\n res -= 1;\n }\n return res;\n }\n\n //Based on the work of Dave
Hoskins\n //https://www.shadertoy.com/view/4djSRW\n #define HASHSCALE1 443.8975\n float
random(float seed){\n vec2 p = resultUV * seed;\n vec3 p3 = fract(vec3(p.xyx) * HASHSCALE1);\n p3
+= dot(p3, p3.yzx + 19.19);\n return fract((p3.x + p3.y) * p3.z);\n }\n\n ${SAMPLE_1D_SNIIPPET}\n
${SAMPLE_2D_SNIIPPET}\n ${SAMPLE_3D_SNIIPPET}\n `;\n\n return SHADER_PREFIX;\n}\n\nconst
SAMPLE_1D_SNIIPPET = `\nvec2 uvFromFlat(int texNumR, int texNumC, int index) {\n int texR = index /
texNumC;\n int texC = index - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nvec2 packedUVfrom1D(int texNumR, int texNumC, int index) {\n int texelIndex = index / 2;\n
texR = texelIndex / texNumC;\n int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) /
vec2(texNumC, texNumR);\n}\n`;\n\nconst SAMPLE_2D_SNIIPPET = `\nvec2 packedUVfrom2D(int
texelsInLogicalRow, int texNumR, int texNumC, int row, int col) {\n int texelIndex = (row / 2) *
texelsInLogicalRow + (col / 2);\n int texR = texelIndex / texNumC;\n int texC = texelIndex - texR * texNumC;\n
return (vec2(texC, texR) + halfCR) / vec2(texNumC, texNumR);\n}\n`;\n\nconst SAMPLE_3D_SNIIPPET = `\nvec2
packedUVfrom3D(int texNumR, int texNumC, int texelsInBatch, int texelsInLogicalRow, int b, int row, int
col) {\n int index = b * texelsInBatch + (row / 2) * texelsInLogicalRow + (col / 2);\n int texR = index /
texNumC;\n int texC = index - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n`;\n\nconst SHADER_PACKED_PREFIX = `\n float getChannel(vec4 frag, vec2 innerDims) {\n
vec2 modCoord = mod(innerDims, 2.);\n return modCoord.x == 0. ? (modCoord.y == 0. ? frag.r : frag.g) :
(modCoord.y == 0. ? frag.b : frag.a);\n }\n float getChannel(vec4 frag, int dim) {\n float modCoord =
mod(float(dim), 2.);\n return modCoord == 0. ? frag.r : frag.g;\n }\n`;\n\nfunction getOutputScalarCoords() {\n
return \n int getOutputCoords() {\n return 0;\n }\n `;\n}\n\nfunction getOutputPacked1DCoords(\n shape:
[number], texShape: [number, number]): string {\n const packedTexShape =\n [Math.ceil(texShape[0] / 2),
Math.ceil(texShape[1] / 2)];\n if (packedTexShape[0] === 1) {\n return \n int getOutputCoords() {\n
return 2 * int(resultUV.x * ${packedTexShape[1]}.0);\n }\n `;\n }\n\n if (packedTexShape[1] === 1) {\n
return \n int getOutputCoords() {\n return 2 * int(resultUV.y * ${packedTexShape[0]}.0);\n }\n `;\n
}\n\n return \n int getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx *
vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n return 2 * (resTexRC.x * ${packedTexShape[1]} +
resTexRC.y);\n }\n `;\n}\n\nfunction getOutput1DCoords(\n shape: [number], texShape: [number, number]):
string {\n if (texShape[0] === 1) {\n return \n int getOutputCoords() {\n return int(resultUV.x *
${texShape[1]}.0);\n }\n `;\n }\n\n if (texShape[1] === 1) {\n return \n int getOutputCoords() {\n
return int(resultUV.y * ${texShape[0]}.0);\n }\n `;\n }\n\n return \n int getOutputCoords() {\n ivec2
resTexRC = ivec2(resultUV.yx *
vec2(${texShape[0]}, ${texShape[1]}));\n return

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resTexRC.x * ${texShape[1]} + resTexRC.y;\n  }\n `;\n}\n\nfunction getOutputPacked3DCoords(\n  shape:
[number, number, number], texShape: [number, number]): string {\n  const packedTexShape =\n
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n  const texelsInLogicalRow = Math.ceil(shape[2] / 2);\n
const texelsInBatch = texelsInLogicalRow * Math.ceil(shape[1] / 2);\n  \n  return ` \n   ivec3 getOutputCoords() {\n
ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${packedTexShape[0]},
${packedTexShape[1]}));\n   int index = resTexRC.x * ${packedTexShape[1]} + resTexRC.y;\n   \n   int b =
index / ${texelsInBatch};\n   index -= b * ${texelsInBatch};\n   \n   int r = 2 * (index / ${texelsInLogicalRow});\n
   int c = imod(index, ${texelsInLogicalRow}) * 2;\n   \n   return ivec3(b, r, c);\n  }\n `;\n}\n\nfunction
getOutput3DCoords(\n  shape: [number, number, number], texShape: [number, number]): string {\n  const
coordsFromIndexSnippet =\n  shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n  \n  return ` \n
   ivec3 getOutputCoords() {\n   ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${texShape[0]},
${texShape[1]}));\n   int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n
${coordsFromIndexSnippet}\n   return ivec3(r, c, d);\n  }\n `;\n}\n\nfunction getOutputPackedNDCoords(\n
shape: number[], texShape: [number, number]): string {\n  const packedTexShape =\n  [Math.ceil(texShape[0] /
2), Math.ceil(texShape[1] / 2)];\n  \n  const texelsInLogicalRow = Math.ceil(shape[shape.length - 1] / 2);\n
const texelsInBatch =\n  texelsInLogicalRow * Math.ceil(shape[shape.length - 2] / 2);\n  let texelsInBatchN =
texelsInBatch;\n  let batches = ``;\n  let coords = 'b, r, c';\n  \n  for (let b = 2; b < shape.length - 1; b++) {\n
texelsInBatchN *= shape[shape.length - b - 1];\n  batches = ` \n   int b${b} = index / ${texelsInBatchN};\n
index -= b${b} * ${texelsInBatchN};\n   ` + batches;\n  coords = `b${b}, ` + coords;\n  }\n  \n  return ` \n
   ivec${shape.length} getOutputCoords() {\n   ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${packedTexShape[0]},
${packedTexShape[1]}));\n   int index = resTexRC.x * ${packedTexShape[1]} +
resTexRC.y;\n   \n   ${batches}\n   \n   int b = index / ${texelsInBatch};\n   index -= b * ${texelsInBatch};\n   \n
int r = 2 * (index / ${texelsInLogicalRow});\n   int c = imod(index, ${texelsInLogicalRow}) * 2;\n   \n   return
ivec${shape.length}(${coords});\n  }\n `;\n}\n\nfunction getOutput4DCoords(\n  shape: [number, number,
number, number],\n  texShape: [number, number]): string {\n  const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n    ['r', 'c', 'd', 'd2'], shape);\n  \n  return ` \n   ivec4
getOutputCoords() {\n   ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${texShape[0]},
${texShape[1]}));\n   int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n   ${coordsFromIndexSnippet}\n
return ivec4(r, c,
d, d2);\n  }\n `;\n}\n\nfunction getOutput5DCoords(\n  shape: [number, number, number, number, number],\n
texShape: [number, number]): string {\n  const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n    ['r', 'c', 'd', 'd2', 'd3'], shape);\n  \n  return ` \n   ivec5
getOutputCoords() {\n   ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${texShape[0]},
${texShape[1]}));\n   int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n   \n   ${coordsFromIndexSnippet}\n
return outShape;\n  }\n `;\n}\n\nfunction getOutput6DCoords(\n  shape: [number, number, number, number, number, number],\n
texShape: [number, number]): string {\n  const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n    ['r', 'c', 'd', 'd2', 'd3', 'd4'], shape);\n  \n  return ` \n   ivec6
getOutputCoords() {\n   ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${texShape[0]},
${texShape[1]}));\n   int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n   \n   ${coordsFromIndexSnippet}\n
return result;\n  }\n `;\n}\n\nfunction getOutputPacked2DCoords(\n  shape:
[number, number], texShape: [number, number]): string {\n  const packedTexShape =\n  [Math.ceil(texShape[0] /
2), Math.ceil(texShape[1] / 2)];\n  \n  if (util.arraysEqual(shape, texShape)) {\n  return ` \n   ivec2 getOutputCoords()
{\n   return 2 * ivec2(resultUV.yx * \n                               vec2(${packedTexShape[0]},
${packedTexShape[1]}));\n  }\n `;\n  }\n  \n  // texels needed to accommodate a logical row\n  const texelsInLogicalRow =
Math.ceil(shape[1] / 2);\n  \n  /**\n   * getOutputCoords\n   * \n   * resTexRC: The rows and columns of the texels. If you move over one\n
* texel to the right in the packed texture, you are moving over one column\n   * (not two).\n   * \n   * index: The texel
index\n   */\n  return ` \n   ivec2 getOutputCoords() {\n   ivec2 resTexRC = ivec2(resultUV.yx * \n                               vec2(${packedTexShape[0]},
${packedTexShape[1]}));\n   int index = resTexRC.x * ${packedTexShape[1]} +

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resTexRC.y;\n    int r = 2 * (index / ${texelsInLogicalRow});\n    int c = imod(index, ${texelsInLogicalRow}) *
2;\n\n    return ivec2(r, c);\n    }\n\n}\n\nfunction getOutput2DCoords(\n    shape: [number, number], texShape:
[number, number]): string {\n    if (util.arraysEqual(shape, texShape)) {\n        return `ivec2 getOutputCoords() {\n
        return ivec2(resultUV.yx * vec2(${texShape[0]}, ${texShape[1]}));\n        }\n    }\n    if (shape[1] === 1) {\n
return `ivec2 getOutputCoords() {\n        ivec2 resTexRC = ivec2(resultUV.yx *\n
vec2(${texShape[0]}, ${texShape[1]}));\n        int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n
return ivec2(index, 0);\n        }\n    }\n    if (shape[0] === 1) {\n        return `ivec2 getOutputCoords() {\n
ivec2 resTexRC = ivec2(resultUV.yx *\n
vec2(${texShape[0]}, ${texShape[1]}));\n        int index
= resTexRC.x * ${texShape[1]} + resTexRC.y;\n        return ivec2(0, index);\n        }\n    }\n    return `ivec2
getOutputCoords() {\n        ivec2 resTexRC = ivec2(resultUV.yx *\n
vec2(${texShape[0]},
${texShape[1]}));\n        int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n        int r = index / ${shape[1]};\n
int c = index - r * ${shape[1]};\n        return ivec2(r, c);\n        }\n    }\n\n}\n\nfunction
getFlatOffsetUniformName(texName: string): string {\n    return `offset${texName}`;\n}\n\nfunction
getPackedSamplerScalar(inputInfo: InputInfo): string {\n    const texName = inputInfo.name;\n    const funcName =
'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n    const glsl = getGlslDifferences();\n    return `ivec4
${funcName}() {\n        return ${glsl.texture2D}(${texName}, halfCR);\n    }\n\n}\n\nfunction
getSamplerScalar(inputInfo: InputInfo): string {\n    const texName = inputInfo.name;\n    const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n    if (inputInfo.shapeInfo.isUniform) {\n        return `float
${funcName}() {\n            return ${texName};\n        }\n    }\n    const [texNumR, texNumC] = inputInfo.shapeInfo.texShape;\n
if (texNumR === 1 && texNumC === 1) {\n        return `float ${funcName}() {\n            return
sampleTexture(${texName}, halfCR);\n        }\n    }\n    const [tNumR, tNumC] =
inputInfo.shapeInfo.texShape;\n    const offset = getFlatOffsetUniformName(texName);\n    return `float
${funcName}() {\n        vec2 uv = uvFromFlat(${tNumR}, ${tNumC}, ${offset});\n        return
sampleTexture(${texName}, uv);\n    }\n\n}\n\nfunction getPackedSampler1D(inputInfo: InputInfo): string {\n
const texName = inputInfo.name;\n    const funcName = 'get' + texName.charAt(0).toUpperCase() +
texName.slice(1);\n    const texShape = inputInfo.shapeInfo.texShape;\n    const packedTexShape =\n
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n    const glsl = getGlslDifferences();\n\n    return `vec4
${funcName}(int index) {\n        vec2 uv = packedUVfrom1D(\n            ${packedTexShape[0]},
${packedTexShape[1]}, index);\n        return ${glsl.texture2D}(${texName}, uv);\n    }\n\n}\n\nfunction
getSampler1D(inputInfo: InputInfo): string {\n    const texName = inputInfo.name;\n    const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n\n    if (inputInfo.shapeInfo.isUniform) {\n        // Uniform
arrays will be less than 65505 (no risk of float16 overflow).\n        return `float ${funcName}(int index) {\n
            ${getUniformSampler(inputInfo)}\n        }\n    }\n    const texShape = inputInfo.shapeInfo.texShape;\n    const
tNumR = texShape[0];\n    const tNumC = texShape[1];\n    if (tNumC === 1 && tNumR === 1) {\n        return `float
${funcName}(int index) {\n            return sampleTexture(${texName}, halfCR);\n        }\n    }\n    const offset
= getFlatOffsetUniformName(texName);\n    if (tNumC === 1) {\n        return `float ${funcName}(int index) {\n
            vec2 uv = vec2(0.5, (float(index + ${offset}) + 0.5) / ${tNumR}.0);\n            return sampleTexture(${texName},
uv);\n        }\n    }\n    if (tNumR === 1) {\n        return `float ${funcName}(int index) {\n            vec2 uv =
vec2((float(index + ${offset}) + 0.5) / ${tNumC}.0, 0.5);\n            return sampleTexture(${texName}, uv);\n        }\n
    }\n\n    return `float ${funcName}(int index) {\n        vec2 uv = uvFromFlat(${tNumR}, ${tNumC}, index +
${offset});\n        return sampleTexture(${texName}, uv);\n    }\n\n}\n\nfunction getPackedSampler2D(inputInfo:
InputInfo): string {\n    const shape = inputInfo.shapeInfo.logicalShape;\n    const texName = inputInfo.name;\n    const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n    const texShape =
inputInfo.shapeInfo.texShape;\n\n    const texNumR = texShape[0];\n    const texNumC = texShape[1];\n    const glsl =
getGlslDifferences();\n    if (texShape != null && util.arraysEqual(shape, texShape)) {\n        return `vec4
${funcName}(int row, int col) {\n            vec2 uv = (vec2(col, row) + halfCR) / vec2(${texNumC}.0,
${texNumR}.0);\n            return ${glsl.texture2D}(${texName}, uv);\n        }\n    }\n    const packedTexShape
=\n    [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n    const valuesPerRow = Math.ceil(shape[1] /

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2);\n\n return \n   vec4 ${funcName}(int row, int col) {\n   vec2 uv = packedUVfrom2D(${valuesPerRow},
${packedTexShape[0]}, ${\n   packedTexShape[1]}, row, col);\n   return ${glsL.texture2D}(${texName}, uv);\n
}\n `;\n}\n\nfunction getSampler2D(inputInfo: InputInfo): string {\n const shape =
inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n\n if
(texShape != null && util.arraysEqual(shape, texShape)) {\n const texNumR = texShape[0];\n const texNumC =
texShape[1];\n return \n   float ${funcName}(int row, int col) {\n   vec2 uv = (vec2(col, row) + halfCR) /
vec2(${texNumC}.0, ${texNumR}.0);\n   return sampleTexture(${texName}, uv);\n   }\n `;\n }\n\n const
{newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if
(squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n
const params = ['row', 'col'];\n return \n   ${getSamplerFromInInfo(newInputInfo)}\n   float ${funcName}(int
row, int col) {\n   return ${funcName}(${getSqueezedParams(params, keptDims)});\n   }\n `;\n }\n\n if
(inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n
return \n   float ${funcName}(int row, int col) {\n   int index = round(dot(vec2(row, col), vec2(${shape[1]},
1)));\n   ${getUniformSampler(inputInfo)}\n   }\n `;\n }\n\n const texNumR = texShape[0];\n const
texNumC = texShape[1];\n const offset = getFlatOffsetUniformName(texName);\n if (texNumC === 1) {\n //
index is used directly as physical (no risk of float16 overflow).\n return \n   float ${funcName}(int row, int col)
{\n   float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n   vec2 uv = vec2(0.5, (index + 0.5) /
${texNumR}.0);\n   return sampleTexture(${texName}, uv);\n   }\n `;\n }\n\n if (texNumR === 1) {\n // index
is used directly as physical (no risk of float16 overflow).\n return \n   float ${funcName}(int row, int col) {\n
float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n   vec2 uv = vec2((index + 0.5) /
${texNumC}.0, 0.5);\n   return sampleTexture(${texName}, uv);\n   }\n `;\n }\n\n return \n float
${funcName}(int row, int col) {\n // Explicitly use integer operations as dot() only works on floats.\n int index =
row * ${shape[1]} + col + ${offset};\n   vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index);\n   return
sampleTexture(${texName}, uv);\n   }\n `;\n }\n\nfunction getPackedSampler3D(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n const
packedTexShape =\n   [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n\n if (shape[0] === 1) {\n
const squeezedShape = shape.slice(1);\n const keptDims = [1, 2];\n const newInputInfo =
squeezeInputInfo(inputInfo, squeezedShape);\n const params = ['b', 'row', 'col'];\n return \n
${getPackedSamplerFromInInfo(newInputInfo)}\n   vec4 ${funcName}(int b, int row, int col) {\n   return
${funcName}(${getSqueezedParams(params, keptDims)});\n   }\n `;\n }\n\n const texNumR =
packedTexShape[0];\n const texNumC = packedTexShape[1];\n const valuesPerRow = Math.ceil(shape[2] / 2);\n
const texelsInBatch = valuesPerRow * Math.ceil(shape[1] / 2);\n const glsl = getGlsLDifferences();\n\n return \n
vec4 ${funcName}(int b, int row, int col) {\n   vec2 uv = packedUVfrom3D(\n     ${texNumR}, ${texNumC},
${texelsInBatch}, ${valuesPerRow}, b, row, col);\n   return ${glsL.texture2D}(${texName}, uv);\n   }\n
`\n }\n\nfunction getSampler3D(inputInfo: InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n
const texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() +
texName.slice(1);\n const stride0 = shape[1] * shape[2];\n const stride1 = shape[2];\n\n const {newShape,
keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if (squeezedShape.length <
shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n const params = ['row',
'col', 'depth'];\n return \n   ${getSamplerFromInInfo(newInputInfo)}\n   float ${funcName}(int row, int col,
int depth) {\n   return ${funcName}(${getSqueezedParams(params, keptDims)});\n   }\n `;\n }\n\n if
(inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n
return \n   float ${funcName}(int row, int col, int depth) {\n   int index = round(dot(vec3(row, col, depth),\n
vec3(${stride0}, ${stride1}, 1)));\n   ${getUniformSampler(inputInfo)}\n   }\n `;\n }\n\n const
texShape = inputInfo.shapeInfo.texShape;\n const texNumR = texShape[0];\n const texNumC = texShape[1];\n
const flatOffset = inputInfo.shapeInfo.flatOffset;\n if (texNumC === stride0 && flatOffset == null) {\n // texC is

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used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int
depth) {\n float texR = float(row);\n float texC = dot(vec2(col, depth), vec2(${stride1}, 1));\n vec2
uv = (vec2(texC, texR) + halfCR) ^\n vec2(${texNumC}.0, ${texNumR}.0);\n return
sampleTexture(${texName}, uv);\n }\n `;\n }\n\n if (texNumC === stride1 && flatOffset == null) {\n //
texR is used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col,
int depth) {\n float texR = dot(vec2(row, col), vec2(${shape[1]}, 1));\n float texC = float(depth);\n vec2 uv
= (vec2(texC, texR) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n `;\n }\n\n const offset = getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int
row, int col, int depth) {\n // Explicitly use integer operations as dot() only works on floats.\n int index =
row * ${stride0} + col * ${stride1} + depth + ${offset};\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC},
index);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\nfunction getPackedSamplerND(inputInfo:
InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n const rank = shape.length;\n const
texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n
const texShape = inputInfo.shapeInfo.texShape;\n const packedTexShape =\n [Math.ceil(texShape[0] / 2),
Math.ceil(texShape[1] / 2)];\n const texNumR = packedTexShape[0];\n const texNumC = packedTexShape[1];\n\n
const valuesPerRow = Math.ceil(shape[rank - 1] / 2);\n let texelsInBatch = valuesPerRow * Math.ceil(shape[rank -
2] / 2);\n let params = `int b, int row, int col`;\n let index = `b * ${texelsInBatch} + (row / 2) * ${valuesPerRow} +
(col / 2)`;\n for (let b = 2; b < rank - 1; b++) {\n params = `int b${b}, ` + params;\n texelsInBatch *= shape[rank -
b - 1];\n index = `b${b} * ${texelsInBatch} + ` + index;\n }\n const glsl = getGlslDifferences();\n return \n
vec4 ${funcName}(${params}) {\n int index = ${index};\n int texR = index / ${texNumC};\n int texC =
index - texR * ${texNumC};\n vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${texNumC}, ${texNumR});\n
return ${glsl.texture2D}(${texName}, uv);\n }\n `;\n }\n\nfunction getSampler4D(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride2 = shape[3];\n const stride1 = shape[2] *
stride2;\n const stride0 = shape[1] * stride1;\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n if
(newShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const
params = ['row', 'col', 'depth', 'depth2'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth, int depth2) {\n return ${funcName}(${getSqueezedParams(params,
keptDims)});\n }\n `;\n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than
65505 (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n
int index = round(dot(vec4(row, col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2},
1)));\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n const flatOffset =
inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const texNumR =
texShape[0];\n const texNumC = texShape[1];\n\n if (texNumC === stride0 && flatOffset == null) {\n // texC is
used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int
depth, int depth2) {\n float texR = float(row);\n float texC =\n dot(vec3(col, depth, depth2),\n
vec3(${stride1}, ${stride2}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR) ^\n vec2(${texNumC}.0,
${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n `;\n }\n\n if (texNumC === stride2 &&
flatOffset == null) {\n // texR is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col, int depth, int depth2) {\n float texR = dot(vec3(row, col, depth),\n
vec3(${shape[1] * shape[2]}, ${shape[2]}, 1));\n float texC = float(depth2);\n vec2 uv = (vec2(texC, texR)
+ halfCR) ^\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n
}\n `;\n }\n\n const offset = getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int
col, int depth, int depth2) {\n // Explicitly use integer operations as dot() only works on floats.\n int index =
row * ${stride0} + col * ${stride1} +\n depth * ${stride2} + depth2;\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index + ${offset});\n return sampleTexture(${texName}, uv);\n }\n
`;\n }\n\nfunction getSampler5D(inputInfo: InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n
const texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() +

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texName.slice(1);\n const stride3 = shape[4];\n const stride2 = shape[3] * stride3;\n const stride1 = shape[2] *
stride2;\n const stride0 = shape[1] * stride1;\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n if
(newShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const
params = ['row', 'col', 'depth', 'depth2', 'depth3'];\n return \n\n ${getSamplerFromInInfo(newInputInfo)}\n
float ${funcName}(int row, int col, int depth, int depth2, int depth3) {\n return
${funcName}(${getSqueezedParams(params, keptDims)});\n }\n\n if (inputInfo.shapeInfo.isUniform)
{\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n\n float ${funcName}(int
row, int col, int depth, int depth2, int depth3) {\n float index = dot(\n vec4(row, col, depth, depth2),\n
vec4(${stride0}, ${stride1}, ${stride2}, ${stride3})) +\n depth3;\n ${getUniformSampler(inputInfo)}\n
}\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape =
inputInfo.shapeInfo.texShape;\n const texNumR = texShape[0];\n const texNumC = texShape[1];\n\n if (texNumC
=== stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16 overflow).\n return
\n\n float ${funcName}(int row, int col, int depth, int depth2, int depth3) {\n int texR = row;\n float texC
= dot(vec4(col, depth, depth2, depth3),\n vec4(${stride1}, ${stride2}, ${stride3}, 1));\n vec2 uv
= (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return
sampleTexture(${texName}, uv);\n }\n\n if (texNumC === stride3 && flatOffset == null) {\n //
texR is used directly as physical (no risk of float16 overflow).\n return \n\n float ${funcName}(int row, int col,
int depth, int depth2, int depth3) {\n float texR = dot(\n vec4(row, col, depth, depth2),\n
vec4(${shape[1] * shape[2] * shape[3]},\n ${shape[2] * shape[3]}, ${shape[3]}, 1));\n int texC =
depth3;\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n
return sampleTexture(${texName}, uv);\n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n\n float ${funcName}(int row, int col, int depth, int depth2, int
depth3) {\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} +
col * ${stride1} + depth * ${stride2} +\n depth2 * ${stride3} + depth3 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName}, uv);\n }\n\n
}\n\nfunction getSampler6D(inputInfo: InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n
const texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() +
texName.slice(1);\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n if (newShape.length <
shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col',
'depth', 'depth2', 'depth3', 'depth4'];\n return \n\n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth,\n int depth2, int depth3, int depth4) {\n return
${funcName}(${getSqueezedParams(params, keptDims)});\n }\n\n const stride4 = shape[5];\n const
stride3 = shape[4] * stride4;\n const stride2 = shape[3] * stride3;\n const stride1 = shape[2] * stride2;\n const
stride0 = shape[1] * stride1;\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505
(no risk of float16 overflow).\n return \n\n float ${funcName}(int row, int col, int depth,\n int depth2,
int depth3, int depth4) {\n int index = round(dot(\n vec4(row, col, depth, depth2),\n vec4(${stride0},
${stride1}, ${stride2}, ${stride3})) +\n dot(\n vec2(depth3, depth4),\n vec2(${stride4}, 1));\n
${getUniformSampler(inputInfo)}\n }\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const
texShape = inputInfo.shapeInfo.texShape;\n const texNumR = texShape[0];\n const texNumC = texShape[1];\n
if (texNumC === stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return \n\n float ${funcName}(int row, int col, int depth,\n int depth2, int depth3, int
depth4) {\n int texR = row;\n float texC = dot(vec4(col, depth, depth2, depth3),\n vec4(${stride1},
${stride2}, ${stride3}, ${stride4})) +\n float(depth4);\n vec2 uv = (vec2(texC, texR) + halfCR) /\n
vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n\n if
(texNumC === stride4 && flatOffset == null) {\n // texR is used directly as physical (no risk of float16
overflow).\n return \n\n float ${funcName}(int row, int col, int depth,\n int depth2, int depth3, int
depth4) {\n float texR = dot(vec4(row, col, depth, depth2),\n vec4(${shape[1] * shape[2] * shape[3] *
shape[4]},\n ${shape[2] * shape[3] * shape[4]},\n ${shape[3] * shape[4]},\n

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    ${shape[4]}) + float(depth3); \n    int texC = depth4; \n    vec2 uv = (vec2(texC, texR) + halfCR) / \n
    vec2(${texNumC}.0, ${texNumR}.0); \n    return sampleTexture(${texName}, uv); \n    } \n `; \n } \n const
offset = getFlatOffsetUniformName(texName); \n return ` \n float ${funcName}(int row, int col, int depth, \n
    int depth2, int depth3, int depth4) { \n // Explicitly use integer operations as dot() only works on floats. \n int
index = row * ${stride0} + col * ${stride1} + depth * ${stride2} + \n    depth2 * ${stride3} + depth3 *
${stride4} + depth4 + ${offset}; \n    vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index); \n    return
sampleTexture(${texName}, uv); \n    } \n `; \n } \n \n function getUniformSampler(inputInfo: InputInfo): string { \n
const texName = inputInfo.name; \n const inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape); \n \n if
(inSize < 2) { \n    return `return ${texName};`; \n } \n return ` \n for (int i = 0; i < ${inSize}; i++) { \n    if (i ==
index) { \n        return ${texName}[i]; \n    } \n } \n `; \n } \n \n function getPackedSamplerAtOutputCoords(\n
inputInfo: InputInfo, outShapeInfo: ShapeInfo) { \n const texName = inputInfo.name; \n const texFuncSnippet =
texName.charAt(0).toUpperCase() + texName.slice(1); \n const funcName = 'get' + texFuncSnippet +
'AtOutCoords'; \n const inRank = inputInfo.shapeInfo.logicalShape.length; \n const outRank =
outShapeInfo.logicalShape.length; \n \n const broadcastDims = getBroadcastDims(\n
inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape); \n \n const type = getCoordsDataType(outRank); \n
const rankDiff = outRank - inRank; \n let coordsSnippet: string; \n const fields = ['x', 'y', 'z', 'w', 'u', 'v']; \n \n if
(inRank === 0) { \n    coordsSnippet = "; \n } else if (outRank < 2 && broadcastDims.length >= 1) { \n
coordsSnippet = 'coords = 0;'; \n } else { \n    coordsSnippet = \n        broadcastDims.map(d => `coords.${fields[d +
rankDiff]} = 0;`) \n        .join("\n"); \n } \n let unpackedCoordsSnippet = "; \n if (outRank < 2 && inRank > 0) { \n
unpackedCoordsSnippet = 'coords'; \n } else { \n    unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape \n
        .map((s, i) => `coords.${fields[i + rankDiff]}`) \n        .join(', '); \n } \n \n let output =
`return outputValue;`; \n const inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape); \n const
isInputScalar = inSize === 1; \n const outSize = util.sizeFromShape(outShapeInfo.logicalShape); \n const
isOutputScalar = outSize === 1; \n \n if (inRank === 1 && !isInputScalar && !isOutputScalar) { \n    output = ` \n
return vec4(outputValue.xy, outputValue.xy); \n    `; \n } else if (isInputScalar && !isOutputScalar) { \n    if (outRank
=== 1) { \n        output = ` \n            return vec4(outputValue.x, outputValue.x, 0., 0.); \n        `; \n    } else { \n        output =
` \n            return vec4(outputValue.x); \n        `; \n    } \n } else if (broadcastDims.length) { \n    const rows = inRank - 2; \n
const cols = inRank - 1; \n    if (broadcastDims.indexOf(rows) > -1 && broadcastDims.indexOf(cols) > -1) { \n
output = `return vec4(outputValue.x);`; \n    } else if (broadcastDims.indexOf(rows) > -1) { \n        output = `return
vec4(outputValue.x, outputValue.y, ` + \n            `outputValue.x, outputValue.y);`; \n    } else if
(broadcastDims.indexOf(cols) > -1) { \n        output = `return vec4(outputValue.xx, outputValue.zz);`; \n    } \n } \n } \n \n
return ` \n vec4 ${funcName}() { \n    ${type} coords = getOutputCoords(); \n    ${coordsSnippet} \n    vec4
outputValue = get${texFuncSnippet}(${unpackedCoordsSnippet}); \n    ${output} \n    } \n `; \n } \n \n function
getSamplerAtOutputCoords(\n    inputInfo: InputInfo, outShapeInfo: ShapeInfo) { \n const texName =
inputInfo.name; \n const texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1); \n const
funcName = 'get' + texFuncSnippet + 'AtOutCoords'; \n const outTexShape = outShapeInfo.texShape; \n const
inTexShape = inputInfo.shapeInfo.texShape; \n const inRank = inputInfo.shapeInfo.logicalShape.length; \n const
outRank = outShapeInfo.logicalShape.length; \n \n if (!inputInfo.shapeInfo.isUniform && inRank === outRank
&& \n    inputInfo.shapeInfo.flatOffset == null && \n    util.arrayEqual(inTexShape, outTexShape)) { \n    return
` \n float ${funcName}() { \n        return sampleTexture(${texName}, resultUV); \n    } \n `; \n } \n \n const type
= getCoordsDataType(outRank); \n const broadcastDims = getBroadcastDims(\n
inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape); \n const rankDiff = outRank - inRank; \n let
coordsSnippet: string; \n const fields = ['x', 'y', 'z', 'w', 'u', 'v']; \n \n if (inRank === 0) { \n    coordsSnippet = "; \n }
else if (outRank < 2 && broadcastDims.length >= 1) { \n    coordsSnippet = 'coords = 0;'; \n } else { \n
coordsSnippet = \n        broadcastDims.map(d => `coords.${fields[d + rankDiff]} = 0;`) \n        .join("\n"); \n } \n
let unpackedCoordsSnippet = "; \n if (outRank < 2 && inRank > 0) { \n    unpackedCoordsSnippet = 'coords'; \n }
else { \n    unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape \n        .map((s, i) =>
`coords.${fields[i + rankDiff]}`) \n        .join(', '); \n } \n \n return ` \n float ${funcName}() { \n

```



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${type} coords = getOutputCoords();\n  ${coordsSnippet}\n  return
get${texFuncSnippet}(${unpackedCoordsSnippet});\n  }\n `;\n\n\nexport function getCoordsDataType(rank:
number): string {\n  if (rank <= 1) {\n    return 'int';\n  } else if (rank === 2) {\n    return 'ivec2';\n  } else if (rank
=== 3) {\n    return 'ivec3';\n  } else if (rank === 4) {\n    return 'ivec4';\n  } else if (rank === 5) {\n    return
'ivec5';\n  } else if (rank === 6) {\n    return 'ivec6';\n  } else {\n    throw Error(`GPU for rank ${rank} is not yet
supported`);\n  }\n}\n\n\n/** Returns a new input info (a copy) that has a squeezed logical shape. */\nfunction
squeezeInputInfo(\n  inInfo: InputInfo, squeezedShape: number[]): InputInfo {\n  // Deep copy.\n  const
newInputInfo: InputInfo = JSON.parse(JSON.stringify(inInfo));\n  newInputInfo.shapeInfo.logicalShape =
squeezedShape;\n  return newInputInfo;\n}\n\n\nfunction getSqueezedParams(params: string[], keptDims: number[]):
string {\n  return keptDims.map(d => params[d]).join(', ');}\n}\n\n\n"/**\n * @license\n * Copyright 2017 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {env, Tensor, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {GPGPUContext} from
'./gpgpu_context';\nimport * as shader_compiler from './shader_compiler';\nimport {InputInfo, ShapeInfo} from
'./shader_compiler';\nimport {PackingScheme, TextureData, TextureUsage} from './tex_util';\n\nexport interface
GPGPUProgram {\n  variableNames: string[];\n  outputShape: number[];\n  userCode: string;\n  /** If true, this
program expects packed input textures. Defaults to false. */\n  packedInputs?: boolean;\n  /** If true, this program
produces a packed texture. Defaults to false. */\n  packedOutput?: boolean;\n  /** \n * Affects what type of texture
we allocate for the output. Defaults to\n * `TextureUsage.RENDER`.\n * \n * outTexUsage?: TextureUsage;\n
/** \n * The type of scheme to use when packing texels for the output values.\n * See `PackingScheme` for details.
Defaults to `PackingScheme.SHARED_BATCH`.\n * \n * outPackingScheme?: PackingScheme;\n}\n\nexport
interface GPGPUBinary {\n  webGLProgram: WebGLProgram;\n  program: GPGPUProgram;\n  uniformLocations:
{[name: string]: WebGLUniformLocation};\n  source: string;\n  inShapeInfos: ShapeInfo[];\n  outShapeInfo:
ShapeInfo;\n  infLoc: WebGLUniformLocation;\n  nanLoc: WebGLUniformLocation;\n}\n\nexport interface
TensorData {\n  shape: number[];\n  texData: TextureData;\n  isUniform: boolean;\n  // Available when we decide to
upload as uniform instead of texture.\n  uniformValues?: TypedArray;\n}\n\nexport function compileProgram<T
extends Tensor, K extends Tensor>(\n  gpgpu: GPGPUContext, program: GPGPUProgram, inputs: TensorData[],\n  output: TensorData): GPGPUBinary {\n  const userCode = program.userCode;\n  const inputInfos: InputInfo[] =
inputs.map((input, i) => {\n    const shapeInfo: ShapeInfo = {\n      logicalShape: input.shape,\n      texShape:
input.isUniform ? null : input.texData.texShape,\n      isUniform: input.isUniform,\n      isPacked: input.isUniform ?
false : input.texData.isPacked,\n      flatOffset: null\n    };\n    if (input.texData != null && input.texData.slice != null
&&\n      input.texData.slice.flatOffset > 0) {\n      shapeInfo.flatOffset = input.texData.slice.flatOffset;\n    }\n    return {name: program.variableNames[i], shapeInfo};\n  });\n  const inShapeInfos = inputInfos.map(x =>
x.shapeInfo);\n  const outShapeInfo: ShapeInfo = {\n    logicalShape: output.shape,\n    texShape:
output.texData.texShape,\n    isUniform: false,\n    isPacked: output.texData.isPacked,\n    flatOffset: null\n  };\n  const source = shader_compiler.makeShader(\n    inputInfos, outShapeInfo, userCode, program.packedInputs);\n  const webGLProgram = gpgpu.createProgram(source);\n  // Add special uniforms (NAN, INFINITY)\n  let
infLoc: WebGLUniformLocation = null;\n  const nanLoc = gpgpu.getUniformLocation(webGLProgram, 'NAN',
false);\n  if (env().getNumber('WEBGL_VERSION') === 1) {\n    infLoc =
gpgpu.getUniformLocation(webGLProgram, 'INFINITY', false);\n  }\n  // Add user-defined uniforms\n  const
uniformLocations: {[name: string]: WebGLUniformLocation} = {};\n  for (let i = 0; i <
program.variableNames.length; i++) {\n    const varName = program.variableNames[i];\n    const shouldThrow =
false;\n    uniformLocations[varName] =\n      gpgpu.getUniformLocation(webGLProgram, varName,

```


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```
=====\n*\n\nimport { Complex, ComplexInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray } from\n '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from '../backend_cpu';\n\nexport function complex(args:\n { inputs: ComplexInputs, backend: MathBackendCPU }):\n TensorInfo {\n  const { inputs, backend } = args;\n  const { real, imag } = inputs;\n\n  const realVals = backend.data.get(real.dataId).values as TypedArray;\n  const imagVals = backend.data.get(imag.dataId).values as TypedArray;\n\n  const complexInfo =\n    backend.makeTensorInfo(real.shape, 'complex64');\n\n  const complex = backend.data.get(complexInfo.dataId);\n\n  // The complex tensor owns the underlying real and imag tensorInfos, only the\n  // complex tensor tracks refCount, when complexData is disposed the\n  // underlying tensorData will be disposed.\n  complex.complexTensorInfos =\n    {\n      real: backend.makeTensorInfo(real.shape, 'float32', realVals),\n      imag: backend.makeTensorInfo(imag.shape, 'float32', imagVals)\n    };\n\n  return complexInfo;\n}\n\nexport const complexConfig: KernelConfig = {\n  kernelName: Complex,\n  backendName: 'cpu',\n  kernelFunc: complex as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { DataType, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from '../backend_cpu';\nimport { complex } from '../kernels/Complex';\n\n/**\n * Generates a tensorInfo with all zeros value.\n * @param backend cpu backend.\n * @param shape Shape for the zeros tensor.\n * @param dtype Optional. If set, the result has this dtype.\n */\nexport function zeros(\n  backend: MathBackendCPU, shape:\n  number[], dtype: DataType = 'float32'):\n  TensorInfo {\n  if (dtype === 'complex64') {\n    const real =\n      zeros(backend, shape, 'float32');\n    const imag = zeros(backend, shape, 'float32');\n\n    return complex({ inputs:\n      { real, imag }, backend});\n  }\n\n  const values = util.makeZerosTypedArray(util.sizeFromShape(shape), dtype);\n\n  return backend.makeTensorInfo(shape, dtype, values);\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { Identity, IdentityInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-\n core';\nimport { MathBackendCPU } from '../backend_cpu';\n\nexport function identity(\n  args: { inputs:\n  IdentityInputs, backend: MathBackendCPU }):\n  TensorInfo {\n  const { inputs, backend } = args;\n  const { x } =\n    inputs;\n\n  backend.incRef(x.dataId);\n\n  return { dataId: x.dataId, shape: x.shape, dtype: x.dtype};\n}\n\nexport const identityConfig: KernelConfig = {\n  kernelName: Identity,\n  backendName: 'cpu',\n  kernelFunc: identity as\n  {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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License.\n *

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*\n\nimport {KernelConfig, KernelFunc, Real, RealInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport\n{MathBackendCPU} from '../backend_cpu';\n\n\nexport function real(args: {inputs: RealInputs, backend:\nMathBackendCPU});\n  TensorInfo {\n  const {inputs, backend} = args;\n  const {input} = inputs;\n\n  const real =\n  backend.data.get(input.dataId).complexTensorInfos.real;\n  const realVal = backend.data.get(real.dataId).values;\n\n  // When complex tensor is disposed, its underlying parts will be disposed too.\n  // Make new tensor out of the real\n  value of the complex. This makes sure the\n  // value is still accessible even if complex tensor is disposed.\n  return\n  backend.makeTensorInfo(real.shape, real.dtype, realVal);\n}\n\n\nexport const realConfig: KernelConfig = {\n  kernelName: Real,\n  backendName: 'cpu',\n  kernelFunc: real as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n
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*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from\n '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nimport\n{createSimpleBinaryKernelImpl} from '../utils/binary_impl';\n\nimport {zeros} from '../utils/zeros_impl';\n\nimport\n{complex} from './Complex';\n\nimport {identity} from './Identity';\n\nimport {real} from './Real';\n\n\nexport function\n  cast(\n  args: {inputs: CastInputs, backend: MathBackendCPU, attrs: CastAttrs});\n  TensorInfo {\n  const\n  {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {dtype} = attrs;\n\n  // Casting to complex64.\n  if\n  (dtype === 'complex64') {\n  if (x.dtype === 'complex64') {\n  return identity({inputs: {x}, backend});\n  }\n\n  const zerosTensorInfo = zeros(backend, x.shape, x.dtype);\n  const floatX = cast({inputs: {x}, backend, attrs:\n  {dtype: 'float32'}});\n\n  const result =\n  complex({inputs: {real: floatX, imag: zerosTensorInfo},\n  backend});\n\n  backend.disposeIntermediateTensorInfo(zerosTensorInfo);\n\n  backend.disposeIntermediateTensorInfo(floatX);\n\n  return result;\n  }\n\n  // Casting from complex64\n  if\n  (x.dtype === 'complex64') {\n  const realPart = real({inputs: {input: x}, backend});\n  const result = cast({inputs:\n  {x: realPart}, backend, attrs: {dtype}});\n\n  backend.disposeIntermediateTensorInfo(realPart);\n\n  return\n  result;\n  }\n\n  if (!util.hasEncodingLoss(x.dtype, dtype)) {\n  // We don't change the underlying data, since we\n  cast to higher\n  // precision.\n  const result = identity({inputs: {x}, backend});\n  return {dataId: result.dataId,\n  shape: result.shape, dtype};\n  }\n\n  if (dtype === 'int32') {\n  const values = backend.data.get(x.dataId).values as\n  TypedArray;\n  const resultValues = Int32Array.from(values);\n  return backend.makeTensorInfo(x.shape, 'int32',\n  resultValues);\n  }\n\n  if (dtype === 'bool') {\n  // This is essentially the result of notEqual(x, 0). We avoid using\n  // kernel notEqual to avoid circular dependency, i.e. binary_utils ->\n  // cast -> notEqual -> binary_utils.\n  const xVals = backend.data.get(x.dataId).values as TypedArray;\n  const zero = util.toTypedArray([0],\n  x.dtype);\n\n  const [resultData, resultShape] = createSimpleBinaryKernelImpl(\n  (a, b) => (a !== b) ? 1 :\n  0)(x.shape, [], xVals, zero, 'bool');\n\n  return backend.makeTensorInfo(resultShape, 'bool', resultData);\n  }\n\n  throw new Error(`Error in Cast: failed to cast ${x.dtype} to ${dtype}`);\n}\n\n\nexport const castConfig:\n  KernelConfig = {\n  kernelName: Cast,\n  backendName: 'cpu',\n  kernelFunc: cast as { } as\n  KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */\n
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*/\n\nimport { backend_util, BinaryInputs, DataType, KernelFunc, TypedArray, util } from '@tensorflow/tfjs-
core';\n\nimport { MathBackendCPU } from './backend_cpu';\nimport { assertNotComplex } from
'./cpu_util';\nimport { cast } from './kernels/Cast';\nimport { complex } from './kernels/Complex';\n\nimport
{ ComplexBinaryKernelImpl, ComplexBinaryOperation, SimpleBinaryKernelImpl } from './binary_types';\n\n/**\n *
Template that creates a `KernelFunc` for binary ops.\n * @param name Kernel name.\n * @param
binaryKernelImpl A `SimpleBinaryKernelImpl` for the kernel.\n * @param binaryKernelComplexImpl Optional. If
exists, represents a\n * `ComplexBinaryKernelImpl` for the kernel, will be used when input dtype\n * is
`complex64`.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same
dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less, Greater, etc.\n
*/\n\nexport function binaryKernelFunc(\n  name: string, simpleImpl: SimpleBinaryKernelImpl,\n  complexImpl?:
ComplexBinaryKernelImpl, dtype?: DataType): KernelFunc {\n  if (complexImpl == null) {\n    return ({inputs,
backend}) => {\n      const {a, b} = inputs as BinaryInputs;\n      const cpuBackend = backend as
MathBackendCPU;\n\n      assertNotComplex([a, b], name);\n      const aVals =
cpuBackend.data.get(a.dataId).values as TypedArray;\n      const bVals = cpuBackend.data.get(b.dataId).values as
TypedArray;\n\n      const $dtype = dtype || a.dtype;\n      const [resultData, resultShape] =\n
simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n      return cpuBackend.makeTensorInfo(resultShape, $dtype,
resultData);\n    }; } }\n\n  return ({inputs, backend}) => {\n    const {a, b} = inputs as BinaryInputs;\n    const
cpuBackend = backend as MathBackendCPU;\n\n    if (a.dtype === 'complex64' || b.dtype === 'complex64') {\n
const $aComplex = cast(\n      inputs: {x: a}, backend: cpuBackend, attrs: { dtype: 'complex64' });\n      const
$aComplexVals = cpuBackend.data.get($aComplex.dataId);\n      const aReal =
$aComplexVals.complexTensorInfos.real;\n      const aImag = $aComplexVals.complexTensorInfos.imag;\n\n      const
aRealVals =\n        cpuBackend.data.get(aReal.dataId).values as Float32Array;\n      const aImagVals =\n
cpuBackend.data.get(aImag.dataId).values as Float32Array;\n\n      const $bComplex = cast(\n        inputs: {x:
b}, backend: cpuBackend, attrs: { dtype: 'complex64' });\n      const $bComplexVals =
cpuBackend.data.get($bComplex.dataId);\n      const bReal = $bComplexVals.complexTensorInfos.real;\n      const
bImag = $bComplexVals.complexTensorInfos.imag;\n\n      const bRealVals =\n
cpuBackend.data.get(bReal.dataId).values as Float32Array;\n      const bImagVals =\n
cpuBackend.data.get(bImag.dataId).values as Float32Array;\n\n      const [resultRealData, resultImagData,
resultShape] = complexImpl(\n        a.shape, b.shape, aRealVals, aImagVals, bRealVals, bImagVals);\n      const
resultReal =\n        cpuBackend.makeTensorInfo(resultShape, 'float32', resultRealData);\n      const resultImag
=\n        cpuBackend.makeTensorInfo(resultShape, 'float32', resultImagData);\n      const result = complex(\n
        inputs: {real: resultReal, imag: resultImag}, backend: cpuBackend);\n\n      cpuBackend.disposeIntermediateTensorInfo($aComplex);\n
      cpuBackend.disposeIntermediateTensorInfo($bComplex);\n      cpuBackend.disposeIntermediateTensorInfo(resultReal);\n
      cpuBackend.disposeIntermediateTensorInfo(resultImag);\n      return result;\n    } else {\n      const aVals =
cpuBackend.data.get(a.dataId).values as TypedArray;\n      const bVals = cpuBackend.data.get(b.dataId).values as
TypedArray;\n\n      const $dtype = dtype || a.dtype;\n      const [resultData, resultShape] =\n
simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n      return cpuBackend.makeTensorInfo(resultShape, $dtype,
resultData);\n    } }\n  }; }\n\n  /**\n   * Template that creates the complex type implementation for binary ops.\n   *
Supports broadcast.\n   */\n  export function createComplexBinaryKernelImpl(op: ComplexBinaryOperation):\n
ComplexBinaryKernelImpl {\n    return (aShape: number[], bShape: number[], aRealVals: Float32Array,\n      aImagVals: Float32Array, bRealVals: Float32Array,\n      bImagVals: Float32Array): [TypedArray, TypedArray,
number[]] => {\n      const resultShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n      const
resultSize = util.sizeFromShape(resultShape);\n      const resultRank = resultShape.length;\n      const resultStrides =
util.computeStrides(resultShape);\n      const resultRealVals = util.getTypedArrayFromDType('float32',
resultSize);\n      const resultImagVals = util.getTypedArrayFromDType('float32', resultSize);\n      const

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aBroadcastDims = backend_util.getBroadcastDims(aShape, resultShape);\n  const bBroadcastDims =
backend_util.getBroadcastDims(bShape, resultShape);\n\n  const aVals =
backend_util.mergeRealAndImagArrays(aRealVals, aImagVals);\n  const bVals =
backend_util.mergeRealAndImagArrays(bRealVals, bImagVals);\n\n  const aRank = aShape.length;\n  const
aStrides = util.computeStrides(aShape);\n\n  const bRank = bShape.length;\n  const bStrides =
util.computeStrides(bShape);\n\n  if (aBroadcastDims.length + bBroadcastDims.length === 0) {\n    for (let i = 0;
i < resultRealVals.length; i++) {\n      const aIdx = i % aVals.length;\n      const bIdx = i % bVals.length;\n\n      const result =\n        op(aVals[aIdx * 2], aVals[aIdx * 2 + 1], bVals[bIdx * 2],\n          bVals[bIdx * 2 + 1]);\n\n      resultRealVals[i] = result.real;\n      resultImagVals[i] = result.imag;\n    } else {\n      for (let i = 0; i <
resultRealVals.length; i++) {\n        const loc = util.indexToLoc(i, resultRank, resultStrides);\n        const aLoc =
loc.slice(-aRank);\n        aBroadcastDims.forEach(d => aLoc[d] = 0);\n        const aIndex = util.locToIndex(aLoc,
aRank, aStrides);\n\n        const bLoc = loc.slice(-bRank);\n        bBroadcastDims.forEach(d => bLoc[d] = 0);\n        const bIndex = util.locToIndex(bLoc, bRank, bStrides);\n\n        const opResult =\n          op(aVals[aIndex * 2],
aVals[aIndex * 2 + 1], bVals[bIndex * 2],\n            bVals[bIndex * 2 + 1]);\n\n        resultRealVals[i] =
opResult.real;\n        resultImagVals[i] = opResult.imag;\n      } }\n    return [resultRealVals, resultImagVals,
resultShape];\n  };\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from
'./utils/binary_impl';\n\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from
'./utils/binary_utils';\n\nexport const addImpl = createSimpleBinaryKernelImpl(((a, b) => a + b));\n\nexport const
addComplexImpl =\n  createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {\n    return {real:
aReal + bReal, imag: aImag + bImag};\n  }));\n\nexport const add = binaryKernelFunc(Add, addImpl,
addComplexImpl);\n\nexport const addConfig: KernelConfig = {\n  kernelName: Add,\n  backendName: 'cpu',\n  kernelFunc: add;\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport {buffer, DataType, Rank, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport
function bincountImpl(\n  xVals: TypedArray, weightsVals: TypedArray, weightsDtype: DataType,\n  weightsShape: number[], size: number): TypedArray {\n  const weightsSize = util.sizeFromShape(weightsShape);\n  const outVals = util.makeZerosTypedArray(size, weightsDtype) as TypedArray;\n\n  for (let i = 0; i < xVals.length;
i++) {\n    const value = xVals[i];\n    if (value < 0) {\n      throw new Error('Input x must be non-negative!');\n    }\n\n    if (value >= size) {\n      continue;\n    }\n\n    if (weightsSize > 0) {\n      outVals[value] +=
weightsVals[i];\n    } else {\n      outVals[value] += 1;\n    } }\n\n  return outVals;\n}\n\nexport function
bincountReduceImpl<R extends Rank>(\n  xBuf: TensorBuffer<R>, weightsBuf: TensorBuffer<R>, size:
number,\n  binaryOutput = false): TensorBuffer<R> {\n  const numRows = xBuf.shape[0];\n  const numCols =
xBuf.shape[1];\n\n  const outBuf = buffer([numRows, size], weightsBuf.dtype);\n\n  for (let i = 0; i < numRows;
i++) {\n    for (let j = 0; j < numCols; j++) {\n      const value = xBuf.get(i, j);\n      if (value < 0) {\n        throw new

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Error('Input x must be non-negative!');\n  }\n\n  if (value >= size) {\n    continue;\n  }\n\n  if\n(binaryOutput) {\n    outBuf.set(1, i, value);\n  } else {\n    if (weightsBuf.size > 0) {\n      outBuf.set(outBuf.get(i, value) + weightsBuf.get(i, j), i, value);\n    } else {\n      outBuf.set(outBuf.get(i, value)\n+ 1, i, value);\n    }\n  }\n}\n}\n}\n}\n}\n\nreturn outBuf as TensorBuffer<R>;\n}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport {NumericDataType, util} from '@tensorflow/tfjs-core';\nimport {SimpleUnaryImpl,\nSimpleUnaryOperation} from './unary_types';\n\n/*\n * Template that creates implementation for unary op.\n */\n\nexport function createSimpleUnaryImpl(op: SimpleUnaryOperation):\n  SimpleUnaryImpl {\n  return (values,\ndtype, attrs) => {\n    const newValues =\n      util.getTypedArrayFromDType(dtype as NumericDataType,\nvalues.length);\n    for (let i = 0; i < values.length; ++i) {\n      newValues[i] = op(values[i], attrs);\n    }\n    return\nnewValues;\n  };\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
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=====\n\n*\n\nimport {DataType, KernelFunc, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';\nimport\n{MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from './cpu_util';\nimport\n{SimpleUnaryImpl, SimpleUnaryOperation} from './unary_types';\n\n/*\n * Template that creates a `KernelFunc`\n * for unary ops.\n * @param name Kernel name.\n * @param op A `SimpleUnaryOperation` for the kernel.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input.\n * This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\n\nexport function\nunaryKernelFunc(\n  name: string, op: SimpleUnaryOperation, dtype?: DataType): KernelFunc {\n  return\n({inputs, attrs, backend}) => {\n    const {x} = inputs as UnaryInputs;\n    assertNotComplex(x, name);\n    if\n(x.dtype === 'string' || dtype === 'string') {\n      throw new Error('unaryKernelFunc does not support string\ninput/output');\n    }\n\n    const cpuBackend = backend as MathBackendCPU;\n    const values =\ncpuBackend.data.get(x.dataId).values as TypedArray;\n    const xSize = util.sizeFromShape(x.shape);\n    const\n$dtype = dtype || x.dtype;\n    const newValues = util.getArrayFromDType($dtype, xSize);\n    for (let i = 0; i <\nxSize; ++i) {\n      newValues[i] = op(values[i], attrs);\n    }\n    return cpuBackend.makeTensorInfo(x.shape,\n$ddtype, newValues);\n  };\n}\n\n/*\n * Template that creates a `KernelFunc` for unary ops from the given\n * `SimpleUnaryImpl`.\n * @param name Kernel name.\n * @param unaryImpl A `SimpleUnaryImpl` that\n * implements the op.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the\n * same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf,\n * etc.\n */\n\nexport function\nunaryKernelFuncFromImpl(\n  name: string, unaryImpl: SimpleUnaryImpl, dtype?:\n  DataType): KernelFunc {\n  return ({inputs, attrs, backend}) => {\n    const {x} = inputs as UnaryInputs;\n    assertNotComplex(x, name);\n    if\n(x.dtype === 'string' || dtype === 'string') {\n      throw new\nError('unaryKernelFunc does not support string input/output');\n    }\n\n    const cpuBackend = backend as\nMathBackendCPU;\n    const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n    const $dtype =\ndtype || x.dtype;\n    const newValues = unaryImpl(values, $dtype, attrs);\n    return\ncpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n  };\n}\n", "/*\n * @license\n * Copyright 2020
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=====\n*\n\nimport {Ceil, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from\n './utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\nexport const ceilImpl =\n createSimpleUnaryImpl((xi) => Math.ceil(xi));\nexport const ceil = unaryKernelFuncFromImpl(Ceil,\n ceilImpl);\nexport const ceilConfig: KernelConfig = {\n  kernelName: Ceil,\n  backendName: 'cpu',\n  kernelFunc:\n  ceil,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {backend_util, BackendValues, DataType, TypedArray, util} from '@tensorflow/tfjs-core';\nexport\n function concatImpl(\n  inputs: Array<{vals: BackendValues, shape: number[]}>, outShape: number[],\n  dtype:\n  DataType, simplyConcat: boolean): TypedArray|string[] {\n  const outVals = util.getArrayFromDType(dtype,\n  util.sizeFromShape(outShape));\n\n  if (simplyConcat && dtype !== 'string') {\n    // Use built-in TypedArray.set()\n    method for speed.\n    let offset = 0;\n    inputs.forEach(input => {\n      const size =\n      util.sizeFromShape(input.shape);\n      (outVals as TypedArray).set(input.vals as TypedArray, offset);\n      offset\n      += size;\n    });\n  } else {\n    let colOffset = 0;\n    inputs.forEach(input => {\n      const decodedData = dtype\n      === 'string' ?\n      backend_util.fromUint8ToStringArray(input.vals as Uint8Array[]) :\n      input.vals as\n      TypedArray;\n      let tIdx = 0;\n      for (let row = 0; row < input.shape[0]; ++row) {\n        const resIdx = row *\n        outShape[1] + colOffset;\n        for (let col = 0; col < input.shape[1]; ++col) {\n          outVals[resIdx + col] =\n          decodedData[tIdx++];\n        }\n        colOffset += input.shape[1];\n      }\n    });\n  }\n\n  return\n  outVals;\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * \n * You\n * may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS\n * IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See\n * the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from\n './utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\nexport const expImpl =\n createSimpleUnaryImpl((xi) => Math.exp(xi));\nexport const exp = unaryKernelFuncFromImpl(Exp,\n expImpl);\nexport const expConfig: KernelConfig = {\n  kernelName: Exp,\n  backendName: 'cpu',\n  kernelFunc:\n  exp,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\n\nimport {Expn1, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from
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./utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\n\nexport const expm1Impl =
createSimpleUnaryImpl((xi) => Math.expm1(xi));\n\nexport const expm1 = unaryKernelFuncFromImpl(Expm1,
expm1Impl);\n\nexport const expm1Config: KernelConfig = {\n  kernelName: Expm1,\n  backendName: 'cpu',\n  kernelFunc: expm1,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
 './utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\n\nexport const floorImpl =
createSimpleUnaryImpl((xi) => Math.floor(xi));\n\nexport const floor = unaryKernelFuncFromImpl(Floor,
floorImpl);\n\nexport const floorConfig: KernelConfig = {\n  kernelName: Floor,\n  backendName: 'cpu',\n  kernelFunc: floor,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\nexport function
gatherV2Impl<R extends Rank, D extends DataType>(\n  xBuf: TensorBuffer<R, D>, indicesBuf:
TensorBuffer<R, D>,\n  flattenOutputShape: number[]): TensorBuffer<R, D> {\n  const outBuf =
buffer(flattenOutputShape, xBuf.dtype);\n  for (let i = 0; i < outBuf.size; ++i) {\n    const newLoc =
outBuf.indexToLoc(i);\n\n    const originalLoc: number[] = newLoc.slice();\n    const batchIdx = originalLoc[0];\n    const indicesIdx = originalLoc[2];\n    const indicesIndex = indicesBuf.locToIndex([batchIdx, indicesIdx]);\n    originalLoc[2] = indicesBuf.values[indicesIndex] as number;\n\n    const originalIndex =
xBuf.locToIndex(originalLoc);\n    outBuf.values[i] = xBuf.values[originalIndex];\n  }\n\n  return outBuf as
TensorBuffer<R, D>;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl}
from './utils/binary_impl';\nimport {binaryKernelFunc} from './utils/binary_utils';\n\nexport const greaterImpl =\ncreateSimpleBinaryKernelImpl((a: number, b: number) => (a > b) ? 1 : 0);\n\nexport const greater =\nbinaryKernelFunc(Greater, greaterImpl, null /* complexImpl */, 'bool');\n\nexport const greaterConfig:
KernelConfig = {\n  kernelName: Greater,\n  backendName: 'cpu',\n  kernelFunc: greater\n};\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from\n './utils/binary_impl';\n\nimport {binaryKernelFunc} from './utils/binary_utils';\n\nexport const lessImpl =\n createSimpleBinaryKernelImpl((a: number, b: number) => (a < b) ? 1 : 0);\n\nexport const less =\n binaryKernelFunc(Less, lessImpl, null /* complexImpl */, 'bool');\n\nexport const lessConfig: KernelConfig = {\n kernelName: Less,\n backendName: 'cpu',\n kernelFunc: less\n};\n\n"/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an\n \"AS IS\"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
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=====\n\n*\n\nimport {TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function linspaceImpl(\n start: number,\n stop: number, num: number): TypedArray {\n const step = (stop - start) / (num - 1);\n const values =\n util.makeZerosTypedArray(num, 'float32');\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n return values;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n License);\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an\n AS IS\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\n permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from\n './utils/unary_impl';\n\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\n\nexport const logImpl =\n createSimpleUnaryImpl((xi) => Math.log(xi));\n\nexport const log = unaryKernelFuncFromImpl(Log,\n logImpl);\n\nexport const logConfig: KernelConfig = {\n kernelName: Log,\n backendName: 'cpu',\n kernelFunc:\n log\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the\n \"License\");\n * you may not use this file\n except in compliance with the License.\n * You\n may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required\n by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n \"AS IS\"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n License for the specific language governing permissions and\n * limitations under the License.\n *\n
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```
=====\n\n*\n\nimport {DataType, NumericDataType, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function\n maxImpl(\n aVals: TypedArray, reduceSize: number, outShape: number[],\n dtype: DataType): TypedArray {\n const vals = util.getTypedArrayFromDType(\n dtype as NumericDataType, util.sizeFromShape(outShape));\n\n for (let i = 0; i < vals.length; ++i) {\n const offset = i * reduceSize;\n let max = aVals[offset];\n for (let j = 0; j < reduceSize; ++j) {\n const value = aVals[offset + j];\n if (value > max) {\n max = value;\n }\n }\n vals[i] = max;\n }\n return vals;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the\n \"License\");\n * you may not use this file\n except in\n compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required\n by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n \"AS IS\"\n BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl}\nfrom './utils/binary_impl';\nimport {binaryKernelFunc} from './utils/binary_utils';\n\nexport const maximumImpl =\ncreateSimpleBinaryKernelImpl(\n  ((aValue, bValue) => Math.max(aValue, bValue)));\nexport const maximum =\nbinaryKernelFunc(Maximum, maximumImpl);\n\nexport const maximumConfig: KernelConfig = {\n  kernelName:\nMaximum,\n  backendName: 'cpu',\n  kernelFunc: maximum\n};\n\n"/**\n * @license\n * Copyright 2020 Google\nLLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\nuse this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl}\nfrom './utils/binary_impl';\nimport {binaryKernelFunc} from './utils/binary_utils';\n\nexport const minimumImpl =\ncreateSimpleBinaryKernelImpl(\n  ((aValue, bValue) => Math.min(aValue, bValue)));\nexport const minimum =\nbinaryKernelFunc(Minimum, minimumImpl);\n\nexport const minimumConfig: KernelConfig = {\n  kernelName:\nMinimum,\n  backendName: 'cpu',\n  kernelFunc: minimum\n};\n\n"/**\n * @license\n * Copyright 2020 Google\nLLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\nuse this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl}\nfrom './utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from\n './utils/binary_utils';\n\nexport const multiplyImpl =\n  createSimpleBinaryKernelImpl(((aValue, bValue) =>\naValue * bValue));\nexport const multiplyComplexImpl =\n  createComplexBinaryKernelImpl(((aReal, aImag,\nbReal, bImag) => {\n    return {\n      real: aReal * bReal - aImag * bImag,\n      imag: aReal * bImag + aImag *\nbReal\n    };\n  }));\n\nexport const multiply =\nbinaryKernelFunc(Multiply, multiplyImpl,\nmultiplyComplexImpl);\n\nexport const multiplyConfig: KernelConfig = {\n  kernelName: Multiply,\n  backendName: 'cpu',\n  kernelFunc: multiply\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\nReserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\nexcept in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
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=====\n\n*\n\nimport {DataType, KernelConfig, KernelFunc, Neg, TensorInfo, TypedArray, UnaryInputs, util} from\n '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from\n './cpu_util';\nimport {multiplyImpl} from './Multiply';\n\nexport function negImpl(xVals: TypedArray, xShape:\nnumber[], xDtype: DataType):\n  [TypedArray, number[]] {\n  const minusOne =\n    util.createScalarValue(-1 as\n  {} as 'float32', xDtype) as TypedArray;\n  return multiplyImpl([], xShape, minusOne, xVals, xDtype);\n}\n\nexport\nfunction neg(args: {inputs: UnaryInputs, backend: MathBackendCPU}):\n  TensorInfo {\n  const {inputs,\nbackend} = args;\n  const {x} = inputs;\n  assertNotComplex(x, 'neg');\n  const xVals =
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backend.data.get(x.dataId).values as TypedArray;\n const [res, newShape] = negImpl(xVals, x.shape, x.dtype);\n\nreturn backend.makeTensorInfo(newShape, x.dtype, res);\n}\n\n\nexport const negConfig: KernelConfig = {\n  kernelName: Neg,\n  backendName: 'cpu',\n  kernelFunc: neg as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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=====\n\n*\n\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\nimport { createSimpleBinaryKernelImpl }\nfrom './utils/binary_impl';\nimport { binaryKernelFunc } from './utils/binary_utils';\n\nexport const notEqualImpl\n=\n  createSimpleBinaryKernelImpl(((a, b) => (a !== b) ? 1 : 0));\n\nexport const notEqual =\n  binaryKernelFunc(NotEqual, notEqualImpl, null /* complexOp */, 'bool');\n\nexport const notEqualConfig:\nKernelConfig = {\n  kernelName: NotEqual,\n  backendName: 'cpu',\n  kernelFunc: notEqual\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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=====\n\n*\n\nimport { DataType, NumericDataType, TypedArray } from '@tensorflow/tfjs-core';\nimport { util } from\n '@tensorflow/tfjs-core';\n\nexport function transposeImpl(\n  xVals: TypedArray, xShape: number[], dtype:\n  DataType, perm: number[],\n  newShape: number[]): TypedArray {\n  const xRank = xShape.length;\n  const xSize\n  = util.sizeFromShape(xShape);\n  const xStrides = util.computeStrides(xShape);\n  const newStrides =\n  util.computeStrides(newShape);\n\n  const result = util.getTypedArrayFromDType(\n    dtype as\n    NumericDataType, util.sizeFromShape(newShape));\n\n  for (let i = 0; i < xSize; ++i) {\n    const loc =\n    util.indexToLoc(i, xRank, xStrides);\n\n    // Permute location.\n    const newLoc: number[] = new\n    Array(loc.length);\n    for (let i = 0; i < newLoc.length; i++) {\n      newLoc[i] = loc[perm[i]];\n    }\n\n    const\n    newIndex = util.locToIndex(newLoc, xRank, newStrides);\n    result[newIndex] = xVals[i];\n  }\n\n  return\n  result;\n}\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *

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=====\n\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs, TypedArray }\nfrom '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from './backend_cpu';\nimport { assertNotComplex }\nfrom './cpu_util';\nimport { transposeImpl } from './Transpose_impl';\n\nexport function transpose(args: {\n  inputs:\n  TransposeInputs,\n  attrs: TransposeAttrs,\n  backend: MathBackendCPU\n}): TensorInfo {\n  const { inputs, attrs,\n  backend } = args;\n  const { x } = inputs;\n  const { perm } = attrs;\n\n  assertNotComplex(x, 'transpose');\n\n  const\n  xRank = x.shape.length;\n  const newShape: number[] = new Array(xRank);\n  for (let i = 0; i < newShape.length;\n  i++) {\n    newShape[i] = x.shape[perm[i]];\n  }\n\n  const values = backend.data.get(x.dataId).values as\n  TypedArray;\n  const result = transposeImpl(values, x.shape, x.dtype, perm, newShape);\n\n  const dataId =\n  backend.write(result, newShape, x.dtype);\n  return { dataId, shape: newShape, dtype: x.dtype};\n}\n\nexport const

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transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'cpu',\n kernelFunc: transpose as
{ } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```
=====\n*\n\nimport { backend_util, DataType, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo,  
TypedArray, upcastType, util } from '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from  
 './backend_cpu';\nimport { assertNotComplex } from './cpu_util';\nimport { transpose } from './Transpose';\n\nexport  
function prodImpl(\n  xShape: number[], xDtype: DataType, xVals: TypedArray,\n  reductionAxes: number[]):\n  {outVals: TypedArray, outShape: number[], outDtype: DataType} {\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(xShape, reductionAxes);\n  const outDtype = upcastType(xDtype,  
'int32');\n  const outVals = util.makeZerosTypedArray(\n    util.sizeFromShape(outShape), outDtype) as  
TypedArray;\n  const reduceSize = util.sizeFromShape(reduceShape);\n  for (let i = 0; i < outVals.length; ++i) {\n    const offset = i * reduceSize;\n    let prod = 1;\n    for (let j = 0; j < reduceSize; ++j) {\n      prod *= xVals[offset +  
j];\n    }\n    outVals[i] = prod;\n  }\n  return {outVals, outShape, outDtype};\n}\n\nexport function prod(\n  args:  
{inputs: ProdInputs, backend: MathBackendCPU, attrs: ProdAttrs}):  
TensorInfo {\n  const {inputs, backend,  
attrs} = args;\n  const {x} = inputs;\n  const {axis, keepDims} = attrs;\n  assertNotComplex(x, 'prod');\n  const  
xRank = x.shape.length;\n  const axes = util.parseAxisParam(axis, x.shape);\n  const permutation =  
backend_util.getAxesPermutation(axes, xRank);\n  let reductionAxes = axes;\n  let permutedX = x;\n  const  
intermediateTensorInfos = [];\n  if (permutation != null) {\n    permutedX = transpose({inputs: {x}, backend, attrs:  
{perm: permutation}});\n    intermediateTensorInfos.push(permutedX);\n    reductionAxes =  
backend_util.getInnerMostAxes(reductionAxes.length, xRank);\n  }\n  const xVals =  
backend.data.get(permutedX.dataId).values as TypedArray;\n  const {outVals, outShape, outDtype} =\n  prodImpl(permutedX.shape, permutedX.dtype, xVals, reductionAxes);\n  let resultShape = outShape;\n  if  
(keepDims) {\n    resultShape = backend_util.expandShapeToKeepDim(outShape, axes);\n  }\n  intermediateTensorInfos.forEach(\n    t => backend.disposeIntermediateTensorInfo(t);\n  );\n  return  
backend.makeTensorInfo(resultShape, outDtype, outVals);\n}\n\nexport const prodConfig: KernelConfig = {\n  kernelName: Prod,\n  backendName: 'cpu',\n  kernelFunc: prod as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the  
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the  
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or  
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *  
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { DataTypeMap, util } from '@tensorflow/tfjs-core';\n\nexport function rangeImpl(\n  start: number,  
stop: number, step: number,\n  dtype: 'float32'|'int32'): DataTypeMap['float32'|'int32'] {\n  const sameStartStop =  
start === stop;\n  const increasingRangeNegativeStep = start < stop && step < 0;\n  const  
decreasingRangePositiveStep = stop < start && step > 1;\n  if (sameStartStop || increasingRangeNegativeStep ||\n  decreasingRangePositiveStep) {\n    return util.makeZerosTypedArray(0, dtype);\n  }\n  const numElements =  
Math.abs(Math.ceil((stop - start) / step));\n  const values = util.makeZerosTypedArray(numElements, dtype);\n  if  
(stop < start && step === 1) {\n    // Auto adjust the step's sign if it hasn't been set\n    // (or was set to 1)\n    step = -  
1;\n  }\n  values[0] = start;\n  for (let i = 1; i < values.length; i++) {\n    values[i] = values[i - 1] + step;\n  }\n  return values;\n}\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * <http://www.apache.org/licenses/LICENSE-2.0>\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createSimpleUnaryImpl} from './utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\nexport const rsqrtImpl = createSimpleUnaryImpl((xi) => 1 / Math.sqrt(xi));\nexport const rsqrt = unaryKernelFuncFromImpl(Rsqrt, rsqrtImpl);\nexport const rsqrtConfig: KernelConfig = {\n  kernelName: Rsqrt,\n  backendName: 'cpu',\n  kernelFunc: rsqrt,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport {backend_util, BackendValues, buffer, DataType, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {assertNotComplex} from './cpu_util';\nexport function sliceImpl(\n  vals: BackendValues, begin: number[], size: number[], shape: number[],\n  dtype: DataType): BackendValues {\n  const isContinuous = slice_util.isSliceContinuous(shape, begin, size);\n  const length = util.sizeFromShape(size);\n  const xStrides = util.computeStrides(shape);\n  if (isContinuous) {\n    const flatOffset = slice_util.computeFlatOffset(begin, xStrides);\n    if (dtype === 'string') {\n      return (vals as Uint8Array[]).slice(flatOffset, flatOffset + length);\n    }\n    return (vals as TypedArray).subarray(flatOffset, flatOffset + length);\n  }\n  const decodedData = dtype === 'string' ?\n    backend_util.fromUint8ToStringArray(vals as Uint8Array[]) :\n    vals as TypedArray;\n  const inBuf = buffer(shape, dtype, decodedData);\n  const outBuf = buffer(size, dtype);\n  for (let i = 0; i < outBuf.size; ++i) {\n    const outLoc = outBuf.indexToLoc(i);\n    const inLoc = outLoc.map((idx: number, j) => idx + begin[j]);\n    outBuf.set(inBuf.get(...inLoc), ...outLoc);\n  }\n  if (dtype === 'string') {\n    return backend_util.fromStringArrayToUint8(outBuf.values as string[]);\n  }\n  return outBuf.values as TypedArray;\n}\n\nexport function slice(\n  args: {inputs: SliceInputs, backend: MathBackendCPU, attrs: SliceAttrs}):\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {begin, size} = attrs;\n  assertNotComplex(x, 'slice');\n  const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);\n  slice_util.assertParamsValid(x, $begin, $size);\n  const vals = backend.data.get(x.dataId).values;\n  const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);\n  return backend.makeTensorInfo($size, x.dtype, outVals);\n}\n\nexport const sliceConfig: KernelConfig = {\n  kernelName: Slice,\n  backendName: 'cpu',\n  kernelFunc: slice as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport
```

```
{createSimpleBinaryKernelImpl} from './utils/binary_impl';\nimport {binaryKernelFunc} from
 './utils/binary_utils';\n\nexport const squaredDifferenceImpl = createSimpleBinaryKernelImpl(((a, b) => {\n const
diff = a - b;\n return diff * diff;\n}));\n\nexport const squaredDifference =\n  binaryKernelFunc(SquaredDifference,
squaredDifferenceImpl);\n\nexport const squaredDifferenceConfig: KernelConfig = {\n kernelName:
SquaredDifference,\n backendName: 'cpu',\n kernelFunc: squaredDifference\n};\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n
*\n\nimport {buffer, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\nexport function stridedSliceImpl<R
extends Rank>(\n  outShape: number[], xBuf: TensorBuffer<R>, strides: number[],\n  begin: number[]):
TensorBuffer<R> {\n  const outBuf = buffer(outShape, xBuf.dtype);\n  for (let i = 0; i < outBuf.size; i++) {\n
const loc = outBuf.indexToLoc(i);\n  const newLoc: number[] = new Array(loc.length);\n  for (let j = 0; j <
newLoc.length; j++) {\n    newLoc[j] = loc[j] * strides[j] + begin[j];\n  }\n  outBuf.set(xBuf.get(...newLoc),
...loc);\n  }\n  return outBuf as TensorBuffer<R>;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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```
=====\n
*\n\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from
 './utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from
 './utils/binary_utils';\n\nexport const subImpl =\n  createSimpleBinaryKernelImpl(((aValue, bValue) => aValue -
bValue));\n\nexport const subComplexImpl =\n  createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) =>
{\n  return {real: aReal - bReal, imag: aImag - bImag};\n }));\n\nexport const sub = binaryKernelFunc(Sub,
subImpl, subComplexImpl);\n\nexport const subConfig: KernelConfig = {\n kernelName: Sub,\n backendName:
'cpu',\n kernelFunc: sub\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\n/*\n * An implementation
of the tile kernel shared between webgl and cpu for string\n * tensors only.\n */\n\nexport function tileImpl<R
extends Rank>(\n  xBuf: TensorBuffer<R, DataType>,\n  reps: number[]): TensorBuffer<R, DataType> {\n  const
newShape: number[] = new Array(xBuf.rank);\n  for (let i = 0; i < newShape.length; i++) {\n    newShape[i] =
xBuf.shape[i] * reps[i];\n  }\n  const result = buffer(newShape, xBuf.dtype);\n  for (let i = 0; i < result.values.length;
++i) {\n    const newLoc = result.indexToLoc(i);\n    const originalLoc: number[] = new Array(xBuf.rank);\n    for
(let j = 0; j < originalLoc.length; j++) {\n      originalLoc[j] = newLoc[j] % xBuf.shape[j];\n    }\n    const
originalIndex = xBuf.locToIndex(originalLoc);\n    result.values[i] = xBuf.values[originalIndex];\n  }\n  return
result as TensorBuffer<R, DataType>;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
```


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```
=====\n*\n\n/** An implementation of the TopK kernel shared between webgl and cpu. */\nimport { buffer, NumericDataType, Rank, ShapeMap, Tensor, TensorBuffer, TypedArray, util } from '@tensorflow/tfjs-core';\nexport function topKImpl<T extends Tensor, R extends Rank>(\n  x: TypedArray, xShape: number[],\n  xDtype: NumericDataType, k: number,\n  sorted: boolean):\n  [TensorBuffer<R, NumericDataType>,\n  TensorBuffer<R, 'int32'>] {\n  // Reshape into a 2d tensor [batch, lastDim] and compute topk along lastDim.\n  const lastDim = xShape[xShape.length - 1];\n  const [batch, size] = [x.length / lastDim, lastDim];\n  const allTopKVals = util.getTypedArrayFromDType(xDtype, batch * k);\n  const allTopKIndices = util.getTypedArrayFromDType('int32', batch * k);\n  for (let b = 0; b < batch; b++) {\n    const offset = b * size;\n    const vals = x.subarray(offset, offset + size);\n    const valAndInd: Array<{ value: number, index: number }> = [];\n    for (let i = 0; i < vals.length; i++) {\n      valAndInd.push({ value: vals[i], index: i });\n    }\n    valAndInd.sort((a, b) => b.value - a.value);\n    const outOffset = b * k;\n    const topKVals = allTopKVals.subarray(outOffset, outOffset + k);\n    const topKIndices = allTopKIndices.subarray(outOffset, outOffset + k);\n    for (let i = 0; i < k; i++) {\n      topKVals[i] = valAndInd[i].value;\n      topKIndices[i] = valAndInd[i].index;\n    }\n  }\n  // Reshape back to the original input shape, except that the last\n  // dimension is k.\n  const outputShape = xShape.slice();\n  outputShape[outputShape.length - 1] = k;\n  return [\n    buffer(outputShape as ShapeMap[R], xDtype, allTopKVals),\n    buffer(outputShape as ShapeMap[R], 'int32', allTopKIndices)\n  ];\n}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { BackendValues, DataType, TensorBuffer, TypedArray, util } from '@tensorflow/tfjs-core';\nexport function uniqueImpl(\n  values: BackendValues, axis: number, shape: number[], dtype: DataType): {\n  outputValues: BackendValues,\n  outputShape: number[],\n  indices: BackendValues\n} {\n  // Normalize and validate axis.\n  const $axis = util.parseAxisParam(axis, shape)[0];\n  // Calculate the new shape that is suitable for extracting data along the\n  // given axis.\n  //\n  // The rank is 3.\n  // The size of the 1st dimension is the size of all the axes < the given axis.\n  // The size of the 2nd dimension is the same as the size of the given axis.\n  // The size of the 3rd dimension is the size of all the axes > the given axis.\n  //\n  // For example, for a 4D tensor with shape=[2, 3, 5, 4] and axis=2, the\n  // newShape would be: [2*3, 5, 4].\n  //\n  // Note that this is not the final output shape. This will be the shape for an\n  // intermediate TensorBuffer (see inputBuffer below) to allow us to extract\n  // values along the given axis. To demonstrate how it works, consider the\n  // following example:\n  //\n  // Input: a 3D tensor, with shape [1, 2, 3]\n  // [\n  //   [\n  //     [1,2,3],\n  //     [4,5,6]\n  //   ]\n  // ]\n  // Axis: 2 (the last axis).\n  // Along axis 2, we expect to extract 3 tensors: [1,4], [2,5], [3,6].\n  //\n  // For this example, newShape would be: [2, 3, 1], where 2 is calculated from\n  // 1*2. The re-shaped data would look like:\n  // [\n  //   [\n  //     [1], [2], [3]\n  //   ],\n  //   [\n  //     [4], [5], [6]\n  //   ]\n  // ]\n  //\n  // Then, we can construct a 3-level nested loop by the following dimension\n  // order to extract the values along the axis (dimension1):\n  // i: dimension1 // 0,1,2\n  // (newShape[1])\n  // m: dimension0 // 0,1 (newShape[0])\n  // n: dimension2 // 0 (newShape[2])\n  //\n  //\n  //\n  // Iteration 0: data at [0, 0, 0] => \"1\"\n  // Iteration 1: data at [1, 0, 0] => \"4\"\n  // We got [1,4].\n  // Iteration 2: data at [0, 1, 0] => \"2\"\n  // Iteration 3: data at [1, 1, 0] => \"5\"\n  // We
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got [2,5].\n // Iteration 4: data at [0, 2, 0] => \"3\"\n // Iteration 5: data at [1, 2, 0] => \"6\"\n // We got [3,6].\n
const newShape = [1, shape[0], 1];\n for (let i = 0; i < $axis; i++) {\n  newShape[0] *= shape[i];\n }\n
newShape[1] = shape[$axis];\n for (let i = $axis + 1; i < shape.length; i++) {\n  newShape[2] *= shape[i];\n }\n\n
// A map from unique elements (their string representations) to their values\n // in \"indices\" (below).\n const
uniqueElements: {[key: string]: number} = {};\n // The indices of each unique element in the original tensor along
the given\n // axis. It is 1D and has the same size as the given axis.\n const indices = new
Int32Array(shape[$axis]);\n // Create a buffer so we can easily extract value at a given location.\n const
inputBuffer = new TensorBuffer(newShape, dtype, values as TypedArray);\n // The indices along the given axis
that have unique elements. This is a\n // de-duped version of \"indices\" above.\n const uniqueIndices: number[] =
[];\n const is1DTensor = newShape[0] === 1 && newShape[2] === 1;\n for (let i = 0; i < shape[$axis]; i++) {\n
// Extract values along the axis.\n  let element: string;\n  if (is1DTensor) {\n    // Fast path for 1D tensor input.\n
    element = values[i].toString();\n  } else {\n    const axisValues = [];\n    for (let m = 0; m < newShape[0]; m++) {\n
    for (let n = 0; n < newShape[2]; n++) {\n      axisValues.push(inputBuffer.get(m, i, n));\n    }\n  }\n
  element = axisValues.join(',');\n }\n // Dedup and update various indices.\n if (uniqueElements[element] !==
undefined) {\n  indices[i] = uniqueElements[element];\n } else {\n  const uniqueIndex =
Object.keys(uniqueElements).length;\n  uniqueElements[element] = uniqueIndex;\n  indices[i] =
uniqueIndex;\n  uniqueIndices.push(i);\n }\n }\n // Now we know where each of the unique elements are
located along the axis\n // (uniqueIndices). Extract them from input buffer and store them in the\n // output
buffer.\n const outputTmpShape = newShape.slice();\n outputTmpShape[1] =
Object.keys(uniqueElements).length;\n const outputBuffer = new TensorBuffer(outputTmpShape, dtype);\n
uniqueIndices.forEach((uniqueElementIndex, i) => {\n  for (let m = 0; m < newShape[0]; m++) {\n    for (let n =
0; n < newShape[2]; n++) {\n      outputBuffer.set(inputBuffer.get(m, uniqueElementIndex, n), m, i, n);\n    }\n
  });\n});\n // The output shape can be calculated from the input shape with the size of\n // the given axis replaced
by the number of unique elements along that axis.\n const outputShape = shape.slice();\n outputShape[$axis] =
outputTmpShape[1];\n\n return {\n  outputValues: outputBuffer.values as BackendValues,\n  outputShape,\n  indices,\n };}\n\n\", \"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\n// Shared functionality among backends.\nexport {simpleAbsImpl} from './kernels/Abs';\nexport {addImpl}
from './kernels/Add';\nexport {bincountImpl, bincountReduceImpl} from './kernels/Bincount_impl';\nexport
{ceilImpl} from './kernels/Ceil';\nexport {concatImpl} from './kernels/Concat_impl';\nexport {expImpl} from
 './kernels/Exp';\nexport {expm1Impl} from './kernels/Expm1';\nexport {floorImpl} from './kernels/Floor';\nexport
{gatherV2Impl} from './kernels/GatherV2_impl';\nexport {greaterImpl} from './kernels/Greater';\nexport {lessImpl}
from './kernels/Less';\nexport {linSpaceImpl} from './kernels/LinSpace_impl';\nexport {logImpl} from
 './kernels/Log';\nexport {maxImpl} from './kernels/Max_impl';\nexport {maximumImpl} from
 './kernels/Maximum';\nexport {minimumImpl} from './kernels/Minimum';\nexport {multiplyImpl} from
 './kernels/Multiply';\nexport {negImpl} from './kernels/Neg';\nexport {notEqualImpl} from
 './kernels/NotEqual';\nexport {prodImpl} from './kernels/Prod';\nexport {rangeImpl} from
 './kernels/Range_impl';\nexport {rsqrtImpl} from './kernels/Rsqrt';\nexport {sliceImpl} from
 './kernels/Slice';\nexport {squaredDifferenceImpl} from './kernels/SquaredDifference';\nexport {stridedSliceImpl}
from './kernels/StridedSlice_impl';\nexport {subImpl} from './kernels/Sub';\nexport {tileImpl} from
 './kernels/Tile_impl';\nexport {topKImpl} from './kernels/TopK_impl';\nexport {transposeImpl} from
 './kernels/Transpose_impl';\nexport {uniqueImpl} from './kernels/Unique_impl';\nexport

```

{ComplexBinaryKernelImpl, SimpleBinaryKernelImpl} from './utils/binary_types';\n", "\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\n// Import shared functionality from tfjs-backend-cpu without triggering\n// side effects.\n// tslint:disable-next-line: no-imports-from-dist\nimport * as shared from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleBinaryKernelImpl} from '@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleUnaryImpl} from '@tensorflow/tfjs-backend-cpu/dist/utils/unary_types';\n\nexport type SimpleBinaryKernelImplCPU = SimpleBinaryKernelImpl;\nexport type SimpleUnaryKernelImplCPU = SimpleUnaryImpl;\n\nconst {\n  addImpl: addImplCPU,\n  bincountImpl: bincountImplCPU,\n  bincountReduceImpl: bincountReduceImplCPU,\n  ceilImpl: ceilImplCPU,\n  concatImpl: concatImplCPU,\n  expImpl: expImplCPU,\n  expm1Impl: expm1ImplCPU,\n  floorImpl: floorImplCPU,\n  gatherV2Impl: gatherV2ImplCPU,\n  greaterImpl: greaterImplCPU,\n  lessImpl: lessImplCPU,\n  lessImplCPU,\n  linspaceImpl: linspaceImplCPU,\n  logImpl: logImplCPU,\n  maxImpl: maxImplCPU,\n  maximumImpl: maximumImplCPU,\n  minimumImpl: minimumImplCPU,\n  multiplyImpl: multiplyImplCPU,\n  negImpl: negImplCPU,\n  prodImpl: prodImplCPU,\n  rangeImpl: rangeImplCPU,\n  rsqrtImpl: rsqrtImplCPU,\n  simpleAbsImpl: simpleAbsImplCPU,\n  sliceImpl: sliceImplCPU,\n  stridedSliceImpl: stridedSliceImplCPU,\n  subImpl: subImplCPU,\n  tileImpl: tileImplCPU,\n  topKImpl: topKImplCPU,\n  transposeImpl: transposeImplCPU,\n  uniqueImpl: uniqueImplCPU,\n} = shared;\n\nexport {\n  addImplCPU,\n  bincountImplCPU,\n  bincountReduceImplCPU,\n  ceilImplCPU,\n  concatImplCPU,\n  expImplCPU,\n  expm1ImplCPU,\n  floorImplCPU,\n  gatherV2ImplCPU,\n  greaterImplCPU,\n  lessImplCPU,\n  linspaceImplCPU,\n  logImplCPU,\n  maxImplCPU,\n  maximumImplCPU,\n  minimumImplCPU,\n  multiplyImplCPU,\n  negImplCPU,\n  prodImplCPU,\n  simpleAbsImplCPU,\n  sliceImplCPU,\n  stridedSliceImplCPU,\n  subImplCPU,\n  rangeImplCPU,\n  rsqrtImplCPU,\n  tileImplCPU,\n  topKImplCPU,\n  transposeImplCPU,\n  uniqueImplCPU,\n};\n", "\n/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nexport function getVecChannels(name: string, rank: number): string[] {\n  return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, rank).map(d => `${name}.${d}`);\n}\n\nexport function getChannels(name: string, rank: number): string[] {\n  if (rank === 1) {\n    return [name];\n  }\n  return getVecChannels(name, rank);\n}\n\nexport function getSourceCoords(rank: number, dims: string[]): string {\n  if (rank === 1) {\n    return 'rc';\n  }\n  let coords = '';\n  for (let i = 0; i < rank; i++) {\n    coords += dims[i];\n    if (i < rank - 1) {\n      coords += ',';\n    }\n  }\n  return coords;\n}\n", "\n/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\nexport class PackProgram implements GPGPUProgram {\n
variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs = false;\n packedOutput =
true;\n\n constructor(\n   outputShape:\n   number[]) { //
TODO(https://github.com/tensorflow/tfjs/issues/893):\n           // Only input / output 3D tensors.\n
this.outputShape = outputShape;\n   const rank = outputShape.length;\n\n   if (rank === 0) {\n   this.userCode =
`\n   void main() {\n   setOutput(vec4(getA(), 0., 0., 0.));\n   }\n   `;\n   } else {\n   const channels =
getChannels('rc', rank);\n   const dtype = getCoordsDataType(rank);\n   const outOfBoundsCondition = \n
getOutOfBoundsCondition(rank, outputShape, channels);\n   const setup = getSetup(\n   rank,
outputShape[outputShape.length - 1],\n   outputShape[outputShape.length - 2], channels);\n   const output =
getOutput(outputShape, channels);\n\n   this.userCode = `\n   void main() {\n   ${dtype} rc =
getOutputCoords();\n\n   if(${outOfBoundsCondition}) {\n   setOutput(vec4(0));\n   } else {\n
${setup}\n\n   setOutput(vec4(${output}));\n   }\n   }\n   `;\n   }\n\n\nfunction
getSourceCoordsArr(rank: number, dims: string[]): string[] {\n   const coords = [];\n\n   for (let row = 0; row <= 1;
row++) {\n   for (let col = 0; col <= 1; col++) {\n   let coord = `${row === 0 ? 'r' : 'rp1'}`, ${col === 0 ? 'c' :
'cp1'}`;\n\n   for (let d = 2; d < rank; d++) {\n   coord = `${dims[dims.length - 1 - d]},` + coord;\n   }\n\n
coords.push(coord);\n   }\n   }\n   return coords;\n\n\nfunction getOutOfBoundsCondition(\n   rank: number, shape:
number[], dims: string[]): string {\n   if (rank === 1) {\n   return `rc > ${shape[0]}`;\n   }\n\n   let cond = ";\n   for (let
i = rank - 2; i < rank; i++) {\n   cond += `${dims[i]} >= ${shape[i]}`;\n   if (i < rank - 1) {\n   cond += "||";\n   }\n
}\n\n   return cond;\n\n\nfunction getSetup(\n   rank: number, cols: number, rows: number, dims: string[]): string
{\n   if (rank === 1) {\n   return ";\n   }\n\n   const innerDims = dims.slice(-2);\n\n   return `\n   int r =
${innerDims[0]};\n   int c = ${innerDims[1]};\n   int rp1 = r + 1;\n   int cp1 = c + 1;\n\n   bool cEdge = cp1 >=
${cols};\n   bool rEdge = rp1 >= ${rows};\n   `;\n\n\nfunction getOutput(shape: number[], dims: string[]): string
{\n   const rank = shape.length;\n   const sourceCoords = getSourceCoordsArr(rank, dims);\n   if (rank === 1) {\n
return `getA(rc),\n   rc + 1 >= ${shape[0]} ? 0. : getA(rc + 1),\n   0, 0`;\n   }\n\n   return
`getA(${sourceCoords[0]},\n   cEdge ? 0. : getA(${sourceCoords[1]},\n   rEdge ? 0. :
getA(${sourceCoords[2]}),\n   rEdge || cEdge ? 0. : getA(${sourceCoords[3]})`;\n\n\n"/**\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport * as shader_util from
'/shader_compiler_util';\n\nexport class ReshapePackedProgram implements GPGPUProgram {\n
variableNames =
['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n
constructor(outputShape: [number, number, number], inputShape: [\n   number, number, number\n   ]) {\n
this.outputShape = outputShape;\n\n   let mainLoop = ``;\n   for (let i = 0; i < 4; i++) {\n   let thisRC = `thisRC =
rc`;\n   if (i % 2 === 1) {\n   thisRC += `thisRC.z += 1`;\n   }\n   if (i > 1) {\n   thisRC += `thisRC.y +=
1`;\n   }\n\n   mainLoop += `\n   ${thisRC}\n   ${i > 0 ? `if(thisRC.y < rows && thisRC.z < cols)` : ``}`;\n\n
int flatIndex = getFlatIndex(thisRC);\n\n   ivec3 inputRC =
inputCoordsFromReshapedOutCoords(flatIndex);\n\n   vec2 inputRCInnerDims =
vec2(float(inputRC.y),float(inputRC.z));\n\n   result[${i}] =\n   getChannel(getA(inputRC.x, inputRC.y,
inputRC.z), inputRCInnerDims);\n   ${i > 0 ? '}' : ''};\n   `;\n   }\n\n   this.userCode = `\n
${getReshapedInputCoords(inputShape)}\n   ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n   void
main() {\n   ivec3 rc = getOutputCoords();\n\n   vec4 result = vec4(0.); \n\n   ivec3 thisRC;\n   int rows =

```

```

    int cols = ${outputShape[2]};
    ${mainLoop}
    setOutput(result);
}
}
function getReshapedInputCoords(shape: [number, number, number]): string {
  const coordsFromIndexSnippet = shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);
  return `ivec3 inputCoordsFromReshapedOutCoords(int index) {
    ${coordsFromIndexSnippet}
    return ivec3(r, c, d);
  }`;
}
"/**
 * @license
 * Copyright 2017 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

```

```

=====
import {env} from '@tensorflow/tfjs-core';
import {GPGPUContext} from './gpgpu_context';
import {getInternalFormatForFloat16MatrixTexture, getInternalFormatForFloat16PackedMatrixTexture,
getInternalFormatForFloat32MatrixTexture, getInternalFormatForPackedMatrixTexture,
getInternalFormatForUnsignedBytesMatrixTexture} from './gpgpu_util';
import {getPackedMatrixTextureShapeWidthHeight, getUnpackedMatrixTextureShapeWidthHeight, PhysicalTextureType,
TextureConfig, TextureUsage} from './tex_util';
export class TextureManager {
  private numUsedTextures = 0;
  private numFreeTextures = 0;
  private _numBytesAllocated = 0;
  private _numBytesFree = 0; // How many bytes that have been allocated
  // are available for reuse.
  private freeTextures: {[shape: string]: WebGLTexture[]} = {};
  private logEnabled = false;
  private usedTextures: {[shape: string]: WebGLTexture[]} = {};
  constructor(private gpgpu: GPGPUContext) {}
  acquireTexture(shapeRC: [number, number], usage: TextureUsage, isPacked: boolean): WebGLTexture {
    const physicalTexType = getPhysicalFromLogicalTextureType(usage, isPacked);
    const shapeKey = getKeyFromTextureShape(shapeRC, physicalTexType, isPacked);
    if (!(shapeKey in this.freeTextures)) {
      this.freeTextures[shapeKey] = [];
    }
    if (!(shapeKey in this.usedTextures)) {
      this.usedTextures[shapeKey] = [];
    }
    const texBytes = computeBytes(shapeRC, physicalTexType, this.gpgpu.gl, this.gpgpu.textureConfig, isPacked);
    if (this.freeTextures[shapeKey].length > 0) {
      this.numFreeTextures--;
      this.numUsedTextures++;
      this._numBytesFree -= texBytes;
      this.log();
      const newTexture = this.freeTextures[shapeKey].shift();
      this.usedTextures[shapeKey].push(newTexture);
      return newTexture;
    }
    let newTexture: WebGLTexture;
    if (physicalTexType === PhysicalTextureType.PACKED_2X2_FLOAT32) {
      newTexture = this.gpgpu.createPackedMatrixTexture(shapeRC[0], shapeRC[1]);
    } else if (physicalTexType === PhysicalTextureType.PACKED_2X2_FLOAT16) {
      newTexture = this.gpgpu.createFloat16PackedMatrixTexture(shapeRC[0], shapeRC[1]);
    } else if (physicalTexType === PhysicalTextureType.UNPACKED_FLOAT32) {
      newTexture = this.gpgpu.createFloat32MatrixTexture(shapeRC[0], shapeRC[1]);
    } else if (physicalTexType === PhysicalTextureType.UNPACKED_FLOAT16) {
      newTexture = this.gpgpu.createFloat16MatrixTexture(shapeRC[0], shapeRC[1]);
    } else if (physicalTexType === PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE) {
      newTexture = this.gpgpu.createUnsignedBytesMatrixTexture(shapeRC[0], shapeRC[1]);
    }
    this.usedTextures[shapeKey].push(newTexture);
    this.numUsedTextures++;
    this._numBytesAllocated += texBytes;
    this.log();
    return newTexture;
  }
  releaseTexture(texture: WebGLTexture, shape: [number, number], logicalTexType: TextureUsage, isPacked: boolean): void {
    if (this.freeTextures == null) {
      // Already disposed.
      return;
    }
    const physicalTexType = getPhysicalFromLogicalTextureType(logicalTexType, isPacked);
    const shapeKey = getKeyFromTextureShape(shape, physicalTexType, isPacked);
    if (!(shapeKey in this.freeTextures)) {
      this.freeTextures[shapeKey] = [];
    }
    const texBytes = computeBytes(shape, physicalTexType,

```

```

this.gpgpu.gl, this.gpgpu.textureConfig, \n    isPacked); \n    const deleteTexThreshold =
env().get('WEBGL_DELETE_TEXTURE_THRESHOLD'); \n    if (deleteTexThreshold !== -1 && \n
this._numBytesAllocated > deleteTexThreshold) { \n    this.gpgpu.deleteMatrixTexture(texture); \n
this._numBytesAllocated -= texBytes; \n    } else { \n    this.freeTextures[shapeKey].push(texture); \n
this.numFreeTextures++; \n    this._numBytesFree += texBytes; \n    } \n \n this.numUsedTextures--; \n \n const
texList = this.usedTextures[shapeKey]; \n    const texIndex = texList.indexOf(texture); \n    if (texIndex < 0) { \n
throw new Error(\n        'Cannot release a texture that was never provided by this ' + \n        'texture manager'); \n
} \n    texList.splice(texIndex, 1); \n    this.log(); \n } \n \n private log() { \n    if (!this.logEnabled) { \n    return; \n
} \n    const total = this.numFreeTextures + this.numUsedTextures; \n    console.log(\n        'Free/Used',
`${this.numFreeTextures} / ${this.numUsedTextures}`, \n        `${total}`); \n    const freeRatio =
this._numBytesFree / this._numBytesAllocated; \n    console.log(`Bytes allocated: ${this._numBytesAllocated}`); \n
console.log(`Bytes unused: ${this._numBytesFree} (${ \n        Math.round(100 * freeRatio)}%)`); \n } \n \n get
numBytesAllocated(): number { \n    return this._numBytesAllocated; \n } \n \n get numBytesFree(): number { \n
return this._numBytesFree; \n } \n \n getNumUsedTextures(): number { \n    return this.numUsedTextures; \n } \n \n
getNumFreeTextures(): number { \n    return this.numFreeTextures; \n } \n \n dispose() { \n    if (this.freeTextures ===
null) { \n    // Already disposed. \n    return; \n    } \n    for (const texShape in this.freeTextures) { \n
this.freeTextures[texShape].forEach(tex => { \n        this.gpgpu.deleteMatrixTexture(tex); \n    }); \n    } \n    for
(const texShape in this.usedTextures) { \n    this.usedTextures[texShape].forEach(tex => { \n
this.gpgpu.deleteMatrixTexture(tex); \n    }); \n    } \n    this.freeTextures = null; \n    this.usedTextures = null; \n
this.numUsedTextures = 0; \n    this.numFreeTextures = 0; \n    this._numBytesAllocated = 0; \n
this._numBytesFree = 0; \n } \n } \n \n function numBytesForInternalFormat(\n    gl: WebGLRenderingContext,
internalFormat: number): number { \n    // tslint:disable-next-line:no-any \n    const glany = gl as any; \n    if
(internalFormat === glany.R32F) { \n    return 4; \n    } else if (internalFormat === glany.R16F) { \n    return 2; \n
} else if (internalFormat === glany.RGBA32F) { \n    return 16; \n    } else if (internalFormat === gl.RGBA) { \n
return 16; \n    } else if (internalFormat === glany.RGBA16F) { \n    return 8; \n    } \n    throw new Error(`Unknown
internal format ${internalFormat}`); \n } \n \n \n export function computeBytes(\n    shape: [number, number],
physicalTexType: PhysicalTextureType, \n    gl: WebGLRenderingContext, textureConfig: TextureConfig, \n
isPacked: boolean): number { \n    // It is not possible to infer packed status from the texture type because \n //
depending on the textureConfig, different texture types may resolve to the \n // same internal format (e.g. in
WebGL1, the internal format for \n // UNPACKED_FLOAT16 textures is gl.RGBA). Therefore we pass in
`isPacked` \n // explicitly. \n    const internalFormat = \n        internalFormatForPhysicalTexType(physicalTexType,
textureConfig); \n \n    let numElements: number; \n    if (isPacked) { \n    const [packedWidth, packedHeight] = \n
getPackedMatrixTextureShapeWidthHeight(shape[0], shape[1]); \n    numElements = packedWidth *
packedHeight; \n \n    } else { \n    const [width, height] = \n
getUnpackedMatrixTextureShapeWidthHeight(shape[0], shape[1]); \n    numElements = width * height; \n    } \n \n
const bytesPerElement = numBytesForInternalFormat(gl, internalFormat); \n    return numElements *
bytesPerElement; \n } \n \n \n function internalFormatForPhysicalTexType(\n    physicalTexType:
PhysicalTextureType, \n    textureConfig: TextureConfig): number { \n    switch (physicalTexType) { \n    case
PhysicalTextureType.PACKED_2X2_FLOAT32: \n    return
getInternalFormatForPackedMatrixTexture(textureConfig); \n    case
PhysicalTextureType.PACKED_2X2_FLOAT16: \n    return
getInternalFormatForFloat16PackedMatrixTexture(textureConfig); \n    case
PhysicalTextureType.UNPACKED_FLOAT32: \n    return
getInternalFormatForFloat32MatrixTexture(textureConfig); \n    case
PhysicalTextureType.UNPACKED_FLOAT16: \n    return
getInternalFormatForFloat16MatrixTexture(textureConfig); \n    case
PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE: \n    return
getInternalFormatForUnsignedBytesMatrixTexture(textureConfig); \n    default: \n    throw new Error(`Unknown

```



```

true;\n\n constructor(aShape: number[], opSnippet: string) {\n  this.outputShape = aShape;\n  this.userCode = `\n
  vec4 unaryOperation(vec4 x) {\n    ${opSnippet}\n  }\n\n  void main() {\n    vec4 x =
  getAAAtOutCoords());\n    vec4 y = unaryOperation(x);\n    setOutput(y);\n  }\n  `;\n }\n}\n"/**\n *
  @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
  2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
  copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
  law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
  the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels, getSourceCoords} from
  './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class UnpackProgram
  implements GPGPUProgram {\n  variableNames = ['A'];\n  packedInputs = true;\n  packedOutput = false;\n
  outputShape: number[];\n  userCode: string;\n\n  constructor(outputShape: number[]) {\n    this.outputShape =
  outputShape;\n    const rank = outputShape.length;\n    const channels = getChannels('rc', rank);\n    const dtype =
  getCoordsDataType(rank);\n    const sourceCoords = getSourceCoords(rank, channels);\n    const innerDims =
  channels.slice(-2);\n    const coords = rank <= 1 ? 'rc' : `vec2(${innerDims.join(',')}`);\n    this.userCode = `\n
  void main() {\n    ${dtype} rc = getOutputCoords();\n    vec4 packedInput = getA(${sourceCoords});\n    setOutput(getChannel(packedInput, ${coords}));\n  }\n  `;\n }\n}\n"/**\n *
  @license\n * Copyright 2017
  Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
  may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
  http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\n// Import webgl flags.\nimport './flags_webgl';\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport
  {backend_util, BackendValues, buffer, DataId, DataStorage, DataType, DataValues, engine, env, kernel_impls,
  KernelBackend, MemoryInfo, NumericDataType, Rank, RecursiveArray, scalar, ShapeMap, Tensor, Tensor2D,
  TensorBuffer, TensorInfo, tidy, TimingInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport
  {getWebGLContext} from './canvas_util';\nimport {DecodeMatrixProgram} from './decode_matrix_gpu';\nimport
  {DecodeMatrixPackedProgram} from './decode_matrix_packed_gpu';\nimport {EncodeFloatProgram} from
  './encode_float_gpu';\nimport {EncodeFloatPackedProgram} from './encode_float_packed_gpu';\nimport
  {EncodeMatrixProgram} from './encode_matrix_gpu';\nimport {EncodeMatrixPackedProgram} from
  './encode_matrix_packed_gpu';\nimport {GPGPUContext} from './gpgpu_context';\nimport * as gpgpu_math from
  './gpgpu_math';\nimport {GPGPUBinary, GPGPUProgram, TensorData} from './gpgpu_math';\nimport
  {simpleAbsImplCPU} from './kernel_utils/shared';\nimport {PackProgram} from './pack_gpu';\nimport
  {ReshapePackedProgram} from './reshape_packed_gpu';\nimport * as tex_util from './tex_util';\nimport
  {TextureData, TextureUsage} from './tex_util';\nimport {TextureManager} from './texture_manager';\nimport * as
  unary_op from './unaryop_gpu';\nimport {UnaryOpProgram} from './unaryop_gpu';\nimport
  {UnaryOpPackedProgram} from './unaryop_packed_gpu';\nimport {UnpackProgram} from './unpack_gpu';\nimport
  * as webgl_util from './webgl_util';\n\nconst whereImpl = kernel_impls.whereImpl;\n\nexport const
  EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 = 1e-4;\n\ninterface KernelInfo = {\n  name: string;\n
  query: Promise<number>;\n};\n\nexport type TimerNode = RecursiveArray<KernelInfo>|KernelInfo;\n\nexport
  interface CPUMeterQuery {\n  startMs: number;\n  endMs?: number;\n}\n\nexport interface WebGLMemoryInfo
  extends MemoryInfo {\n  numBytesInGPU: number;\n  // Tracks the total number of bytes allocated on the GPU,
  accounting for the\n  // physical texture type.\n  numBytesInGPUAllocated: number;\n  // Tracks byte size of
  textures that were created and then made available for\n  // reuse (disposed).\n  numBytesInGPUFree: number;\n

```



```

unreliable: boolean;\n}\n\nexport interface WebGLTimingInfo extends TimingInfo {\n  uploadWaitMs: number;\n  downloadWaitMs: number;\n}\n\nconst binaryCaches: {[webGLVersion: string]: {[key: string]: GPGPUBinary}} =
{\n}\n\nexport function getBinaryCache(webGLVersion: number) {\n  if (webGLVersion in binaryCaches) {\n    return binaryCaches[webGLVersion];\n  }\n  binaryCaches[webGLVersion] = {};\n  return
binaryCaches[webGLVersion];\n}\n\n// Empirically determined constant used to determine size threshold for
handling\n// off execution to the CPU.\nconst CPU_HANDOFF_SIZE_THRESHOLD = 128;\n\n// Empirically
determined constant used to decide the number of MB on GPU\n// before we warn about high memory use. The MB
are this constant * screen area\n// * dpi / 1024 / 1024.\nconst BEFORE_PAGING_CONSTANT = 600;\n\nfunction
numMBBeforeWarning(): number {\n  if (env().global.screen == null) {\n    return 1024; // 1 GB.\n  }\n  return
(env().global.screen.height * env().global.screen.width *\n    window.devicePixelRatio) *\n  BEFORE_PAGING_CONSTANT / 1024 / 1024;\n}\n\nexport class MathBackendWebGL extends KernelBackend
{\n  texData: DataStorage<TextureData>;\n  gpgpu: GPGPUContext;\n\n  private static nextDataId = 0;\n  private
nextDataId(): number {\n    return MathBackendWebGL.nextDataId++;\n  }\n  // Maps data ids that have a pending
read operation, to list of subscribers.\n  private pendingRead = new WeakMap<DataId, Array<(arr: TypedArray) =>
void>>());\n  // List of data ids that are scheduled for disposal, but are waiting on a\n  // pending read operation.\n
private pendingDisposal = new WeakSet<DataId>;\n\n  // Used to count the number of 'shallow' sliced tensors that
point to the\n  // same data id.\n  dataRefCount = new WeakMap<DataId, number>();\n  private numBytesInGPU =
0;\n\n  private canvas: HTMLCanvasElement|OffscreenCanvas;\n\n  private programTimersStack: TimerNode[];\n
private activeTimers: TimerNode[];\n  // Accumulated time spent (including blocking) in uploading data to webgl.\n
private uploadWaitMs = 0;\n  // Accumulated time spent (including blocking in downloading data from webgl.\n
private downloadWaitMs = 0;\n  private cpuBackend: KernelBackend;\n\n  // Number of bits of precision of this
backend.\n  private floatPrecisionValue: 32|16;\n\n  private textureManager: TextureManager;\n  private
binaryCache: {[key: string]: GPGPUBinary};\n  private gpgpuCreatedLocally: boolean;\n  private
numMBBeforeWarning: number;\n  private warnedAboutMemory = false;\n  private warnedAboutCPUBackend =
false;\n\n  constructor(gpgpu?: GPGPUContext) {\n    super();\n    if (!env().getBool('HAS_WEBGL')) {\n      throw
new Error('WebGL is not supported on this device');\n    }\n\n    if (gpgpu == null) {\n      const gl =
getWebGLContext(env().getNumber('WEBGL_VERSION'));\n      this.binaryCache =
getBinaryCache(env().getNumber('WEBGL_VERSION'));\n      this.gpgpu = new GPGPUContext(gl);\n      this.canvas =
gl.canvas;\n      this.gpgpuCreatedLocally = true;\n    } else {\n      this.gpgpu = gpgpu;\n      this.binaryCache =
{};\n      this.gpgpuCreatedLocally = false;\n      this.canvas = gpgpu.gl.canvas;\n    }\n\n    this.textureManager =
new TextureManager(this.gpgpu);\n    this.numMBBeforeWarning =
numMBBeforeWarning();\n\n    this.texData = new DataStorage(this, engine());\n  }\n\n  numDataIds() {\n    return
this.texData.numDataIds() +\n      (this.cpuBackend ? this.cpuBackend.numDataIds() : 0) -\n      this.pendingDeletes;\n  }\n\n  write(values: BackendValues, shape: number[], dtype: DataType): DataId {\n    if
(env().getBool('WEBGL_CHECK_NUMERICAL_PROBLEMS') ||\n      env().getBool('DEBUG')) {\n      this.checkNumericalProblems(values);\n    }\n\n    if (dtype === 'complex64' && values != null) {\n      throw new
Error(\n      `Cannot write to a complex64 dtype.` +\n      `Please use tf.complex(real, imag).`);\n    }\n\n    const
dataId = {id: this.nextDataId()};\n    this.texData.set(\n      dataId,\n      {shape, dtype, values, usage:
TextureUsage.UPLOAD, refCount: 1});\n    return dataId;\n  }\n\n  /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n    if (this.texData.has(dataId)) {\n      const tensorData =
this.texData.get(dataId);\n      return tensorData.refCount;\n    }\n    return 0;\n  }\n\n  /** Increase refCount of a
`TextureData`. */\n  incRef(dataId: DataId): void {\n    const texData = this.texData.get(dataId);\n
texData.refCount++;\n  }\n\n  /** Decrease refCount of a `TextureData`. */\n  decRef(dataId: DataId): void {\n    if
(this.texData.has(dataId)) {\n      const texData = this.texData.get(dataId);\n      texData.refCount--;\n    }\n  }\n\n  move(\n    dataId: DataId, values: BackendValues, shape: number[], dtype: DataType,\n    refCount: number):
void {\n    if (env().getBool('DEBUG')) {\n      this.checkNumericalProblems(values);\n    }\n\n    if (dtype ===
'complex64') {\n      throw new Error(\n      `Cannot write to a complex64 dtype.` +\n      `Please use
tf.complex(real, imag).`);\n    }\n\n    this.texData.set(\n      dataId, {shape, dtype, values, usage:

```

```

TextureUsage.UPLOAD, refCount});\n }\n\n disposeIntermediateTensorInfo(tensorInfo: TensorInfo): void {\n
this.disposeData(tensorInfo.dataId);\n }\n\n readSync(dataId: DataId): BackendValues {\n  const texData =
this.texData.get(dataId);\n  const { values, dtype, complexTensorInfos, slice, shape, isPacked } = texData;\n\n  //
The presence of `slice` indicates this tensor is a shallow slice of a\n  // different tensor, and is using that original
tensor's texture. Run\n  // `clone` in order to copy that texture and read from it.\n  if (slice != null) {\n    let
program;\n    if (isPacked) {\n      program = new UnaryOpPackedProgram(shape, unary_op.CLONE);\n    } else
{\n      program = new UnaryOpProgram(shape, unary_op.CLONE);\n    }\n    const res =\n
this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);\n    const data = this.readSync(res.dataId);\n
this.disposeIntermediateTensorInfo(res);\n    return data;\n  }\n  if (values != null) {\n    return
this.convertAndCacheOnCPU(dataId);\n  }\n  if (dtype === 'string') {\n    return values;\n  }\n  const
shouldTimeProgram = this.activeTimers != null;\n  let start: number;\n  if (shouldTimeProgram) {\n    start =
util.now();\n  }\n\n  let result: Float32Array;\n  if (dtype === 'complex64') {\n    const realValues =\n
this.readSync(complexTensorInfos.real.dataId) as Float32Array;\n    const imagValues =\n
this.readSync(complexTensorInfos.imag.dataId) as Float32Array;\n    result =
backend_util.mergeRealAndImagArrays(realValues, imagValues);\n  } else {\n    result =
this.getValuesFromTexture(dataId);\n  }\n\n  if (shouldTimeProgram) {\n    this.downloadWaitMs += util.now()
- start;\n  }\n  return this.convertAndCacheOnCPU(dataId, result);\n }\n\n async read(dataId: DataId):
Promise<BackendValues> {\n  if (this.pendingRead.has(dataId)) {\n    const subscribers =
this.pendingRead.get(dataId);\n    return new Promise<TypedArray>(resolve => subscribers.push(resolve));\n  }\n
  const texData = this.texData.get(dataId);\n  const { values, shape, slice, dtype, complexTensorInfos, isPacked } =
texData;\n\n  // The presence of `slice` indicates this tensor is a shallow slice of a\n  // different tensor, and is
using that original tensor's texture. Run\n  // `clone` in order to copy that texture and read from it.\n  if (slice !=
null) {\n    let program;\n    if (isPacked) {\n      program = new UnaryOpPackedProgram(shape,
unary_op.CLONE);\n    } else {\n      program = new UnaryOpProgram(shape, unary_op.CLONE);\n    }\n
const res =\n    this.runWebGLProgram(program, [{dataId, shape, dtype}], dtype);\n    const data =
this.read(res.dataId);\n    this.disposeIntermediateTensorInfo(res);\n    return data;\n  }\n\n  if (values != null)
{\n    return this.convertAndCacheOnCPU(dataId);\n  }\n\n  if
(!env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED') &&\n
env().getNumber('WEBGL_VERSION') === 2) {\n    throw new Error(\n      `tensor.data() with
WEBGL_DOWNLOAD_FLOAT_ENABLED=false and ` +\n      `WEBGL_VERSION=2 not yet supported.`);\n  }\n
  let buffer = null;\n  let tmpDownloadTarget: TensorInfo;\n\n  if (dtype !== 'complex64' &&
env().get('WEBGL_BUFFER_SUPPORTED')) {\n    // Possibly copy the texture into a buffer before inserting a
fence.\n    tmpDownloadTarget = this.decode(dataId);\n    const tmpData =
this.texData.get(tmpDownloadTarget.dataId);\n    buffer = this.gpgpu.createBufferFromTexture(\n
tmpData.texture, ...tex_util.getDenseTexShape(shape));\n  }\n\n  this.pendingRead.set(dataId, []);\n\n  if (dtype
!== 'complex64') {\n    // Create a fence and wait for it to resolve.\n    await
this.gpgpu.createAndWaitForFence();\n  }\n\n  // Download the values from the GPU.\n  let vals:
Float32Array;\n  if (dtype === 'complex64') {\n    const ps = await Promise.all([\n
this.read(complexTensorInfos.real.dataId),\n    this.read(complexTensorInfos.imag.dataId)\n  ]);\n\n    const
realValues = ps[0];\n    const imagValues = ps[1];\n    vals = backend_util.mergeRealAndImagArrays(\n
realValues as Float32Array, imagValues as Float32Array);\n  } else if (buffer == null) {\n    vals =
this.getValuesFromTexture(dataId);\n  } else {\n    const size = util.sizeFromShape(shape);\n    vals =
this.gpgpu.downloadFloat32MatrixFromBuffer(buffer, size);\n  }\n\n  if (tmpDownloadTarget != null) {\n
this.disposeIntermediateTensorInfo(tmpDownloadTarget);\n  }\n\n  const dTypeVals =
this.convertAndCacheOnCPU(dataId, vals);\n\n  const subscribers = this.pendingRead.get(dataId);\n
this.pendingRead.delete(dataId);\n\n  // Notify all pending reads.\n  subscribers.forEach(resolve =>
resolve(dTypeVals));\n  if (this.pendingDisposal.has(dataId)) {\n    this.pendingDisposal.delete(dataId);\n  }
if (this.disposeData(dataId)) {\n    engine().removeDataId(dataId, this);\n  }\n\n  this.pendingDeletes--;\n  }\n

```

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return dTypeVals;
}

bufferSync<R extends Rank>(t: TensorInfo): TensorBuffer<R> {
  const data = this.readSync(t.dataId);
  let decodedData = data as DataValues;
  if (t.dtype === 'string') {
    try {
      // Decode the bytes into string.
      decodedData = (data as Uint8Array[]).map(d => util.decodeString(d));
    } catch {
      throw new Error('Failed to decode encoded string bytes into utf-8');
    }
  }
  return buffer(t.shape as ShapeMap[R], t.dtype, decodedData) as TensorBuffer<R>;
}

private checkNumericalProblems(values: BackendValues): void {
  if (values == null) return;
  for (let i = 0; i < values.length; i++) {
    const num = values[i] as number;
    if (!webgl_util.canBeRepresented(num)) {
      if (env().getBool('WEBGL_RENDER_FLOAT32_CAPABLE')) {
        throw Error(`The value ${num} cannot be represented with your ` +
          `current settings. Consider enabling float32 rendering: ` +
          `tf.env().set('WEBGL_RENDER_FLOAT32_ENABLED', true);`);
      }
      throw Error(`The value ${num} cannot be represented on this device.`);
    }
  }
}

private getValuesFromTexture(dataId: DataId): Float32Array {
  const {shape, dtype, isPacked} = this.texData.get(dataId);
  const size = util.sizeFromShape(shape);
  if (env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED')) {
    const tmpTarget = this.decode(dataId);
    const tmpData = this.texData.get(tmpTarget.dataId);
    const vals = this.gpgpu.downloadMatrixFromPackedTexture(
      tmpData.texture, ...tex_util.getDenseTexShape(shape))
      .subarray(0, size);
    this.disposeIntermediateTensorInfo(tmpTarget);
    return vals;
  }
  const shouldUsePackedProgram = env().getBool('WEBGL_PACK') && isPacked === true;
  const outputShape = shouldUsePackedProgram ? webgl_util.getShapeAs3D(shape) : shape;
  const program = shouldUsePackedProgram ? new EncodeFloatPackedProgram(outputShape as [number, number, number]) :
    new EncodeFloatProgram(outputShape);
  const output = this.runWebGLProgram(program, [{shape: outputShape, dtype, dataId}], 'float32');
  const tmpData = this.texData.get(output.dataId);
  const vals = this.gpgpu.downloadByteEncodedFloatMatrixFromOutputTexture(
    tmpData.texture, tmpData.texShape[0], tmpData.texShape[1])
    .subarray(0, size);
  this.disposeIntermediateTensorInfo(output);
  return vals;
}

timerAvailable(): boolean {
  return env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0;
}

async time(f: () => void): Promise<WebGLTimingInfo> {
  const oldActiveTimers = this.activeTimers;
  const newActiveTimers: TimerNode[] = [];
  let outerMostTime = false;
  if (this.programTimersStack == null) {
    this.programTimersStack = newActiveTimers;
    outerMostTime = true;
  } else {
    this.activeTimers.push(newActiveTimers);
  }
  this.activeTimers = newActiveTimers;
  f();
  // needing to split these up because util.flatten only accepts certain types
  const flattenedActiveTimerQueries = util.flatten(this.activeTimers.map((d: KernelInfo) => d.query))
    .filter(d => d != null);
  const flattenedActiveTimerNames = util.flatten(this.activeTimers.map((d: KernelInfo) => d.name))
    .filter(d => d != null);
  this.activeTimers = oldActiveTimers;
  if (outerMostTime) {
    this.programTimersStack = null;
  }
  const res: WebGLTimingInfo = {
    uploadWaitMs: this.uploadWaitMs,
    downloadWaitMs: this.downloadWaitMs,
    kernelMs: null,
    wallMs: null // will be filled by the engine
  };
  if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {
    const kernelMs = await Promise.all(flattenedActiveTimerQueries);
    res['kernelMs'] = util.sum(kernelMs);
    res['getExtraProfileInfo'] = () => kernelMs.map((d, i) => ({name: flattenedActiveTimerNames[i], ms: d}))
      .map(d => `${d.name}: ${d.ms}`)
      .join(', ');
  } else {
    res['kernelMs'] = {
      error: 'WebGL query timers are not supported in this environment.';
    };
  }
  this.uploadWaitMs = 0;
  this.downloadWaitMs = 0;
  return res;
}

memory(): WebGLMemoryInfo {
  return {
    unreliable: false,
    numBytesInGPU: this.numBytesInGPU,
    numBytesInGPUAllocated: this.textureManager.numBytesAllocated,
    numBytesInGPUFree: this.textureManager.numBytesFree
  } as WebGLMemoryInfo;
}

private startTimer(): WebGLQuery|CPUTimerQuery {
  if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {
    return this.gpgpu.beginQuery();
  }
  return {startMs: util.now(), endMs: null};
}

private endTimer(query: WebGLQuery|CPUTimerQuery): WebGLQuery|CPUTimerQuery {
  if

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(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n
this.gpgpu.endQuery();\n return query;\n }\n (query as CPUTimerQuery).endMs = util.now();\n return
query;\n }\n\n private async getQueryTime(query: WebGLQuery|CPUTimerQuery): Promise<number> {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return
this.gpgpu.waitForQueryAndGetTime(query as WebGLQuery);\n }\n const timerQuery = query as
CPUTimerQuery;\n return timerQuery.endMs - timerQuery.startMs;\n }\n\n private pendingDeletes = 0;\n
/**\n * Decrease the RefCount on the dataId and dispose the memory if the dataId\n * has 0 refCount. If there are
pending read on the data, the disposal would\n * added to the pending delete queue. Return true if the dataId is
removed\n * from backend or the backend does not contain the dataId, false if the\n * dataId is not removed.
Memory may or may not be released even when dataId\n * is removed, which also depends on dataRefCount, see
`releaseGPU`\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.pendingDisposal.has(dataId)) {\n return false;\n
}\n\n // No-op if already disposed.\n if (!this.texData.has(dataId)) {\n return true;\n }\n\n // if force flag is
set, change refCount to 0, this would ensure disposal\n // when added to the pendingDisposal queue. Memory may
or may not be\n // released, which also depends on dataRefCount, see `releaseGPU`\n if (force) {\n
this.texData.get(dataId).refCount = 0;\n } else {\n this.texData.get(dataId).refCount--;\n }\n\n if (!force &&
this.texData.get(dataId).refCount > 0) {\n return false;\n }\n\n if (this.pendingRead.has(dataId)) {\n
this.pendingDisposal.add(dataId);\n this.pendingDeletes++;\n return false;\n }\n\n
this.releaseGPUData(dataId);\n const {complexTensorInfos} = this.texData.get(dataId);\n if
(complexTensorInfos != null) {\n this.disposeData(complexTensorInfos.real.dataId, force);\n
this.disposeData(complexTensorInfos.imag.dataId, force);\n }\n\n this.texData.delete(dataId);\n\n return
true;\n }\n\n private releaseGPUData(dataId: DataId): void {\n const {texture, dtype, texShape, usage, isPacked,
slice} =\n this.texData.get(dataId);\n const key = slice && slice.origDataId || dataId;\n const refCount =
this.dataRefCount.get(key);\n\n if (refCount > 1) {\n this.dataRefCount.set(key, refCount - 1);\n } else {\n
this.dataRefCount.delete(key);\n if (texture != null) {\n this.numBytesInGPU -=
this.computeBytes(texShape, dtype);\n this.textureManager.releaseTexture(texture, texShape, usage,
isPacked);\n }\n }\n\n const texData = this.texData.get(dataId);\n texData.texture = null;\n
texData.texShape = null;\n texData.isPacked = false;\n texData.slice = null;\n }\n\n getTexture(dataId: DataId):
WebGLTexture {\n this.uploadToGPU(dataId);\n return this.texData.get(dataId).texture;\n }\n\n /**\n *
Returns internal information for the specific data bucket. Used in unit\n * tests.\n */\n
getDataInfo(dataId: DataId): TextureData {\n return this.texData.get(dataId);\n }\n\n private getCPUBackend(): KernelBackend|null
{\n if (!env().getBool('WEBGL_CPU_FORWARD')) {\n return null;\n }\n\n if (this.cpuBackend == null)
{\n this.cpuBackend = engine().findBackend('cpu');\n }\n\n return this.cpuBackend;\n }\n\n /**\n Tests
whether all the inputs to an op are small and on the CPU. This heuristic\n determines when it would be faster to
execute a kernel on the CPU. WebGL\n kernels opt into running this check and forwarding when appropriate.\n
TODO(https://github.com/tensorflow/tfjs/issues/872): Develop a more\n sustainable strategy for optimizing
backend execution of ops.\n */\n
shouldExecuteOnCPU(inputs: TensorInfo[],\n sizeThreshold =
CPU_HANDOFF_SIZE_THRESHOLD): boolean {\n const cpuBackend = this.getCPUBackend();\n if
(!env().getBool('IS_TEST') && !this.warnedAboutCPUBackend &&\n cpuBackend == null) {\n
console.warn(\n 'Your application contains ops that are small enough to be ' +\n 'executed on the CPU
backend, however the CPU backend cannot ' +\n 'be found. Consider importing the CPU backend ' +\n
'(@tensorflow/tfjs-backend-cpu) for better performance.);\n this.warnedAboutCPUBackend = true;\n }\n\n
return cpuBackend != null &&\n inputs.every(\n input => this.texData.get(input.dataId).texture == null
&&\n util.sizeFromShape(input.shape) < sizeThreshold);\n }\n\n getGPGPUContext(): GPGPUContext
{\n return this.gpgpu;\n }\n\n where(condition: Tensor): Tensor2D {\n backend_util.warn(\n 'tf.where() in
webgl locks the UI thread. ' +\n 'Call tf.whereAsync() instead');\n const condVals = condition.dataSync();\n
return whereImpl(condition.shape, condVals);\n }\n\n private packedUnaryOp(x: TensorInfo, op: string, dtype:
DataType) {\n const program = new UnaryOpPackedProgram(x.shape, op);\n const outInfo =

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this.compileAndRun(program, [x], dtype);\n  return engine().makeTensorFromDataId(\n    outInfo.dataId,\n    outInfo.shape, outInfo.dtype);\n  }\n\n  // TODO(msoulanille) remove this once the backend has been modularized\n  // a copy is needed here to break a circular dependency.\n  // Also remove the op from unary_op.\n  abs<T extends\n  Tensor>(x: T): T {\n    // TODO: handle cases when x is complex.\n    if (this.shouldExecuteOnCPU([x]) &&\n    x.dtype !== 'complex64') {\n      const outValues =\n        simpleAbsImplCPU(this.texData.get(x.dataId).values as\n        TypedArray);\n      return this.makeOutput(x.shape, x.dtype, outValues);\n    }\n    if\n    (env().getBool('WEBGL_PACK_UNARY_OPERATIONS')) {\n      return this.packedUnaryOp(x, unary_op.ABS,\n      x.dtype) as T;\n    }\n\n    const program = new UnaryOpProgram(x.shape, unary_op.ABS);\n    const outInfo =\n    this.compileAndRun(program, [x]);\n    return engine().makeTensorFromDataId(\n      outInfo.dataId,\n      outInfo.shape, outInfo.dtype) as T;\n  }\n\n  makeTensorInfo(\n    shape: number[], dtype: DataType,\n    values?:\n    BackendValues|string[]): TensorInfo {\n    let dataId;\n    if (dtype === 'string' && values != null && values.length\n    > 0 &&\n    util.isString(values[0])) {\n      const encodedValues =\n        (values as {}) as string[]).map(d =>\n        util.encodeString(d));\n      dataId = this.write(encodedValues, shape, dtype);\n    } else {\n      dataId =\n      this.write(values as TypedArray, shape, dtype);\n    }\n\n    this.texData.get(dataId).usage = null;\n    return {dataId,\n    shape, dtype};\n  }\n\n  private makeOutput<T extends Tensor>(\n    shape: number[], dtype: DataType, values?:\n    BackendValues): T {\n    const {dataId} = this.makeTensorInfo(shape, dtype, values);\n    return\n    engine().makeTensorFromDataId(dataId, shape, dtype, this) as T;\n  }\n\n  private unpackTensor(input: TensorInfo):\n  TensorInfo {\n    const program = new UnpackProgram(input.shape);\n    return this.runWebGLProgram(program,\n    [input], input.dtype);\n  }\n\n  private packTensor(input: TensorInfo): TensorInfo {\n    const program = new\n    PackProgram(input.shape);\n    const preventEagerUnpackingOutput = true;\n    return this.runWebGLProgram(\n    program, [input], input.dtype, null /* customSetup */,\n    preventEagerUnpackingOutput);\n  }\n\n  private\n  packedReshape(input: TensorInfo, afterShape: number[]): TensorInfo {\n    const input3DShape = [\n    webgl_util.getBatchDim(input.shape),\n    ...webgl_util.getRowsCols(input.shape)\n    ] as [number, number,\n    number];\n    const input3D: TensorInfo = {\n      dtype: input.dtype,\n      shape: input3DShape,\n      dataId:\n      input.dataId\n    }; \n    const afterShapeAs3D = [\n    webgl_util.getBatchDim(afterShape),\n    ...webgl_util.getRowsCols(afterShape)\n    ] as [number, number, number];\n    const program = new\n    ReshapePackedProgram(afterShapeAs3D, input3DShape);\n    const preventEagerUnpackingOfOutput = true;\n    const output = this.runWebGLProgram(\n    program, [input3D], input.dtype, null /* customSetup */,\n    preventEagerUnpackingOfOutput);\n    return {dataId: output.dataId, shape: afterShape, dtype: output.dtype};\n  }\n\n  private decode(dataId: DataId): TensorInfo {\n    const texData = this.texData.get(dataId);\n    const\n    {isPacked, shape, dtype} = texData;\n    const shapeAs3D =\n    webgl_util.getShapeAs3D(shape) as [number,\n    number, number];\n    let program;\n    if (isPacked) {\n      program = new\n      DecodeMatrixPackedProgram(shapeAs3D);\n    } else {\n      program = new DecodeMatrixProgram(shapeAs3D);\n    }\n    const preventEagerUnpackingOfOutput = true;\n    const out = this.runWebGLProgram(\n    program,\n    [{shape: shapeAs3D, dtype, dataId}], dtype,\n    null /* customSetup */, preventEagerUnpackingOfOutput);\n    return {dtype, shape, dataId: out.dataId};\n  }\n\n  runWebGLProgram(\n    program: GPGPUProgram, inputs:\n    TensorInfo[], outputDtype: DataType,\n    customSetup?: (gpgpu: GPGPUContext, webGLProgram:\n    WebGLProgram) => void,\n    preventEagerUnpackingOfOutput = false): TensorInfo {\n    const output =\n    this.makeTensorInfo(program.outputShape, outputDtype);\n    const outData = this.texData.get(output.dataId);\n    if\n    (program.packedOutput) {\n      outData.isPacked = true;\n    }\n    if (program.outPackingScheme ===\n    tex_util.PackingScheme.DENSE) {\n      const texelShape = tex_util.getDenseTexShape(program.outputShape);\n      // For a densely packed output, we explicitly set texShape\n      // so it doesn't get assigned later according to our\n      typical packing\n      // scheme wherein a single texel can only contain values from adjacent\n      // rows/cols.\n      outData.texShape = texelShape.map(d => d * 2) as [number, number];\n    }\n    if (program.outTexUsage != null)\n    {\n      outData.usage = program.outTexUsage;\n    }\n    if (util.sizeFromShape(output.shape) === 0) {\n      //\n      Short-circuit the computation since the result is empty (has 0 in its\n      // shape).\n      outData.values =\n      util.getTypedArrayFromDType(output.dtype as 'float32', 0);\n      return output;\n    }\n\n    const dataToDispose:\n    TensorInfo[] = [];\n    const inputsData: TensorData[] = inputs.map(input => {\n      if (input.dtype === 'complex64')

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{\n    throw new Error(\n        `GPGPUProgram does not support complex64 input. For complex64` +\n
`dtypes, please separate the program into real and imaginary` +\n
`parts.`);\n    }\n\n    let texData =
this.texData.get(input.dataId);\n    if (texData.texture == null) {\n        if (!program.packedInputs &&\n
util.sizeFromShape(input.shape) <= \n
env().getNumber('WEBGL_SIZE_UPLOAD_UNIFORM')) {\n
// Upload small tensors that live on the CPU as uniforms, not as\n
// textures. Do this only when the
environment supports 32bit floats\n
// due to problems when comparing 16bit floats with 32bit floats.\n
//
TODO(https://github.com/tensorflow/tfjs/issues/821): Make it\n
// possible for packed shaders to sample from
uniforms.\n
return {\n
shape: input.shape,\n
texData: null,\n
isUniform: true,\n
uniformValues: texData.values as TypedArray\n
};\n
}\n\n    // This ensures that if a packed program's
inputs have not yet been\n
// uploaded to the GPU, they get uploaded as packed right off the bat.\n
if
(program.packedInputs) {\n
texData.isPacked = true;\n
texData.shape = input.shape;\n
}\n
} else
if (!texData.isPacked !== !program.packedInputs) {\n
input = texData.isPacked ? this.unpackTensor(input) : \n
this.packTensor(input);\n
dataToDispose.push(input);\n
texData =
this.texData.get(input.dataId);\n
} else if (\n
texData.isPacked &&\n
!webgl_util.isReshapeFree(texData.shape, input.shape)) {\n
// This is a special case where a texture exists for a
tensor\n
// but the shapes are incompatible (due to packing constraints) because\n
// the tensor did not have
a chance to go through the packed reshape\n
// shader. This only happens when we reshape the *same* tensor to
form\n
// *distinct* inputs to an op, e.g. dotting a vector with itself. This\n
// case will disappear once
packed uploading is the default.\n\n
const savedInput = input;\n
const targetShape = input.shape;\n\n
input.shape = texData.shape;\n
input = this.packedReshape(input as Tensor, targetShape);\n
dataToDispose.push(input);\n
texData = this.texData.get(input.dataId);\n
savedInput.shape =
targetShape;\n
}\n\n
this.uploadToGPU(input.dataId);\n
return {shape: input.shape, texData, isUniform:
false};\n
});\n\n
this.uploadToGPU(output.dataId);\n
const outputData:\n
TensorData = {shape:
output.shape, texData: outData, isUniform: false};\n
const key = gpgpu_math.makeShaderKey(program,
inputsData, outputData);\n
const binary = this.getAndSaveBinary(key, () => {\n
return
gpgpu_math.compileProgram(\n
this.gpgpu, program, inputsData, outputData);\n
});\n
const
shouldTimeProgram = this.activeTimers != null;\n
let query: WebGLQuery|CPUTimerQuery;\n
if
(shouldTimeProgram) {\n
query = this.startTimer();\n
}\n\n
gpgpu_math.runProgram(\n
this.gpgpu,
binary, inputsData, outputData, customSetup);\n\n
dataToDispose.forEach(info =>
this.disposeIntermediateTensorInfo(info));\n\n
if (shouldTimeProgram) {\n
query = this.endTimer(query);\n
this.activeTimers.push(\n
{name: program.constructor.name, query: this.getQueryTime(query)});\n
}\n\n
if
(!env().getBool('WEBGL_LAZILY_UNPACK') && outData.isPacked &&\n
preventEagerUnpackingOfOutput
=== false) {\n
const unpacked = this.unpackTensor(output);\n
this.disposeIntermediateTensorInfo(output);\n
return unpacked;\n
}\n
return output;\n
}\n\n
compileAndRun(\n
program: GPGPUProgram, inputs:
TensorInfo[], outputDtype?: DataType,\n
customSetup?: (gpgpu: GPGPUContext, webGLProgram:
WebGLProgram) => void,\n
preventEagerUnpackingOfOutput = false): TensorInfo {\n
outputDtype =
outputDtype || inputs[0].dtype;\n
const outInfo = this.runWebGLProgram(\n
program, inputs, outputDtype,
customSetup,\n
preventEagerUnpackingOfOutput);\n
return outInfo;\n
}\n\n
private getAndSaveBinary(key:
string, getBinary: () => GPGPUBinary):\n
GPGPUBinary {\n
if (!(key in this.binaryCache)) {\n
this.binaryCache[key] = getBinary();\n
}\n
return this.binaryCache[key];\n
}\n\n
private getTextureManager():
TextureManager {\n
return this.textureManager;\n
}\n\n
private disposed = false;\n
dispose() {\n
if
(this.disposed) {\n
return;\n
}\n
// Avoid disposing the compiled webgl programs during unit testing
because\n
// it slows down test execution.\n
if (!env().getBool('IS_TEST')) {\n
const allKeys =
Object.keys(this.binaryCache);\n
allKeys.forEach(key => {\n
this.gpgpu.deleteProgram(this.binaryCache[key].webGLProgram);\n
delete this.binaryCache[key];\n
});\n
}\n
this.textureManager.dispose();\n
if (this.canvas != null &&\n
(typeof (HTMLCanvasElement) !==
'undefined' &&\n
this.canvas instanceof HTMLCanvasElement)) {\n
this.canvas.remove();\n
} else {\n
this.canvas = null;\n
}\n
if (this.gpgpuCreatedLocally) {\n
this.gpgpu.program = null;\n
}
}

```

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this.gpgpu.dispose();\n }\n this.disposed = true;\n }\n\n floatPrecision(): 16|32 {\n if (this.floatPrecisionValue\n == null) {\n this.floatPrecisionValue = tidy() => {\n if\n (!env().get('WEBGL_RENDER_FLOAT32_ENABLED')) {\n // Momentarily switching DEBUG flag to false\n so we don't throw an\n // error trying to upload a small value.\n const debugFlag =\n env().getBool('DEBUG');\n env().set('DEBUG', false);\n const underflowCheckValue =\n this.abs(scalar(1e-8)).dataSync()[0];\n env().set('DEBUG', debugFlag);\n\n if (underflowCheckValue >\n 0) {\n return 32;\n }\n }\n return 16;\n });\n }\n return this.floatPrecisionValue;\n }\n\n /** Returns the smallest representable number. */\n epsilon(): number {\n return this.floatPrecision() === 32 ?\n EPSILON_FLOAT32 : EPSILON_FLOAT16;\n }\n\n uploadToGPU(dataId: DataId): void {\n const texData =\n this.texData.get(dataId);\n const {shape, dtype, values, texture, usage, isPacked} = texData;\n\n if (texture !=\n null) {\n // Array is already on GPU. No-op.\n return;\n }\n\n const shouldTimeProgram = this.activeTimers\n != null;\n let start: number;\n if (shouldTimeProgram) {\n start = util.now();\n }\n\n let texShape =\n texData.texShape;\n if (texShape == null) {\n texShape =\n webgl_util.getTextureShapeFromLogicalShape(shape, isPacked);\n texData.texShape = texShape;\n }\n\n if\n (values != null) {\n const shapeAs3D = webgl_util.getShapeAs3D(shape);\n\n let program;\n let width =\n texShape[1], height = texShape[0];\n const isByteArray = values instanceof Uint8Array;\n\n if (isPacked) {\n [width, height] = tex_util.getPackedMatrixTextureShapeWidthHeight(\n texShape[0], texShape[1]);\n program = new EncodeMatrixPackedProgram(\n shapeAs3D, [height, width], isByteArray);\n } else {\n program =\n new EncodeMatrixProgram(shapeAs3D, [height, width], isByteArray);\n }\n\n const\n tempDenseInputHandle = this.makeTensorInfo([height, width], dtype);\n if (isByteArray) {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.PIXELS;\n } else {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.UPLOAD;\n }\n\n this.gpgpu.uploadDenseMatrixToTexture(\n this.getTexture(tempDenseInputHandle.dataId), width, height,\n values as TypedArray);\n\n // We want the output to remain packed regardless of the value of\n //\n WEBGL_PACK.\n const preventEagerUnpacking = true;\n const encodedOutputTarget =\n this.runWebGLProgram(\n program, [tempDenseInputHandle], dtype, null, preventEagerUnpacking);\n\n //\n Have the original texture assume the identity of the encoded output.\n const outputTexData =\n this.texData.get(encodedOutputTarget.dataId);\n texData.texture = outputTexData.texture;\n texData.texShape\n = outputTexData.texShape;\n texData.isPacked = outputTexData.isPacked;\n texData.usage =\n outputTexData.usage;\n\n this.disposeIntermediateTensorInfo(tempDenseInputHandle);\n\n this.texData.delete(encodedOutputTarget.dataId);\n\n // Once uploaded, don't store the values on cpu.\n texData.values = null;\n if (shouldTimeProgram) {\n this.uploadWaitMs += util.now() - start;\n }\n }\n\n else {\n const newTexture = this.acquireTexture(texShape, usage, dtype, isPacked);\n texData.texture =\n newTexture;\n }\n }\n\n private convertAndCacheOnCPU(dataId: DataId, float32Values?: Float32Array):\n TypedArray {\n const texData = this.texData.get(dataId);\n const {dtype} = texData;\n\n this.releaseGPUData(dataId);\n\n if (float32Values != null) {\n texData.values =\n float32ToTypedArray(float32Values, dtype as 'float32');\n }\n\n return texData.values as TypedArray;\n }\n\n private acquireTexture(\n texShape: [number, number], texType: TextureUsage, dtype: DataType,\n isPacked:\n boolean): WebGLTexture {\n this.numBytesInGPU += this.computeBytes(texShape, dtype);\n\n if\n (!this.warnedAboutMemory &&\n this.numBytesInGPU > this.numMBBeforeWarning * 1024 * 1024) {\n const mb = (this.numBytesInGPU / 1024 / 1024).toFixed(2);\n this.warnedAboutMemory = true;\n console.warn(\n `High memory usage in GPU: ${mb} MB, ` +\n `most likely due to a memory leak`);\n }\n\n return this.textureManager.acquireTexture(texShape, texType, isPacked);\n }\n\n private\n computeBytes(shape: [number, number], dtype: DataType) {\n return shape[0] * shape[1] *\n util.bytesPerElement(dtype);\n }\n\n\nfunction float32ToTypedArray<D extends NumericDataType>(\n a:\n Float32Array, dtype: D): tf.DataTypeMap[D] {\n if (dtype === 'float32' || dtype === 'complex64') {\n return a as\n tf.DataTypeMap[D];\n } else if (dtype === 'int32' || dtype === 'bool') {\n const result = (dtype === 'int32') ? new\n Int32Array(a.length) :\n new Uint8Array(a.length);\n for (let i = 0; i < result.length; ++i)

```

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{\n  result[i] = Math.round(a[i]);\n } \n  return result as tf.DataTypeMap[D];\n } else {\n  throw new
Error('Unknown dtype ${dtype}');\n }\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nimport * as gpgpu_util from './gpgpu_util';\nimport * as
webgl_util from './webgl_util';\n\nexport {MathBackendWebGL, WebGLMemoryInfo, WebGLTimingInfo} from
'./backend_webgl';\nexport {setWebGLContext} from './canvas_util';\nexport {GPGPUContext} from
'./gpgpu_context';\nexport {GPGPUProgram} from './gpgpu_math';\n// WebGL specific utils.\nexport {gpgpu_util,
webgl_util};\n\n/**\n * Enforce use of half precision textures if available on the platform.\n *\n * @doc {heading:
'Environment', namespace: 'webgl'}\n *\nexport function forceHalfFloat(): void {\n
env().set('WEBGL_FORCE_F16_TEXTURES', true);\n}\n}\n", "/*\n * @license\n * Copyright 2017 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport const CHECK_NAN_SNIPPET = `\n  if (isnan(a)) return a;\n  if (isnan(b)) return
b;\n`;\n\nexport const SQUARED_DIFFERENCE = `return (a - b) * (a - b);`\n\nexport class BinaryOpProgram
implements GPGPUProgram {\n  variableNames = ['A', 'B'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(op: string, aShape: number[], bShape: number[]) {\n    this.outputShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n    this.userCode = `\n    float binaryOperation(float
a, float b) {\n      ${op}\n    }\n\n    void main() {\n      float a = getAAAtOutCoords();\n      float b =
getBAAtOutCoords();\n      setOutput(binaryOperation(a, b));\n    }\n`;\n  }\n}\n}\n", "/*\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport const CHECK_NAN_SNIPPET = `\n  result.r = isNaN.r > 0. ? NAN : result.r;\n
result.g = isNaN.g > 0. ? NAN : result.g;\n  result.b = isNaN.b > 0. ? NAN : result.b;\n  result.a = isNaN.a > 0. ?
NAN : result.a;\n`;\n\nexport const ELU_DER = `\n  vec4 bGTEZero = vec4(greaterThanEqual(b, vec4(0.))); \n
return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));\n`;\n\nexport const NOT_EQUAL = `\n
return vec4(notEqual(a, b));\n`;\n\nexport class BinaryOpPackedProgram implements GPGPUProgram {\n
  variableNames = ['A', 'B'];\n  outputShape: number[];\n  userCode: string;\n  supportsBroadcasting = true;\n
  packedInputs = true;\n  packedOutput = true;\n\n  constructor(\n    op: string, aShape: number[], bShape:
number[],\n    checkOutOfBounds = false) {\n    this.outputShape =

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backend_util.assertAndGetBroadcastShape(aShape, bShape);\n  const rank = this.outputShape.length;\n  let\n  checkOutOfBoundsString = ";\n  if (checkOutOfBounds) {\n    if (rank === 0 ||\n    util.sizeFromShape(this.outputShape) === 1) {\n      checkOutOfBoundsString = `\n      result.y = 0.;\n      result.z = 0.;\n      result.w = 0.;\n      `;\n    } else {\n      const dtype = getCoordsDataType(rank);\n      checkOutOfBoundsString = `\n      ${dtype} coords = getOutputCoords();\n      `;\n      if (rank === 1) {\n        checkOutOfBoundsString += `\n        result.y = (coords + 1) >= ${this.outputShape[0]} ? 0. : result.y;\n        result.z = 0.;\n        result.w = 0.;\n        `;\n      } else {\n        const channels = getChannels('coords', rank);\n        checkOutOfBoundsString += `\n        bool nextRowOutOfBounds =\n        (${channels[rank - 2]} + 1) >=\n        ${this.outputShape[rank - 2]};\n        bool nextColOutOfBounds =\n        (${channels[rank - 1]} + 1) >=\n        ${this.outputShape[rank - 1]};\n        result.y = nextColOutOfBounds ? 0. : result.y;\n        result.z =\n        nextRowOutOfBounds ? 0. : result.z;\n        result.w = nextColOutOfBounds || nextRowOutOfBounds ? 0. :\n        result.w;\n        `;\n      }\n    }\n  }\n  this.userCode = `\n  vec4 binaryOperation(vec4 a, vec4 b) {\n  ${op}\n  }\n  void main() {\n    vec4 a = getAAtOutCoords();\n    vec4 b = getBAtOutCoords();\n    vec4 result = binaryOperation(a, b);\n    ${checkOutOfBoundsString}\n    setOutput(result);\n  }\n  `;\n  }\n  }"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {env, KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util}\nfrom '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport\n{BinaryOpProgram} from '../binaryop_gpu';\nimport {BinaryOpPackedProgram} from\n../binaryop_packed_gpu';\n\nexport const LEAKYRELU = `return (a < 0.) ? b * a : a;`\n\nexport const\nLEAKYRELU_PACKED = `\n  vec4 aLessThanZero = vec4(lessThan(a, vec4(0.)));\n  return (aLessThanZero * (b\n  * a)) + ((vec4(1.0) - aLessThanZero) * a);`\n\n\nexport function leakyRelu(args: {\n  inputs: LeakyReluInputs,\n  backend: MathBackendWebGL,\n  attrs: LeakyReluAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} =\n  args;\n  const {x} = inputs;\n  const {alpha} = attrs;\n\n  const $alpha = backend.makeTensorInfo([\n    [],\n    'float32',\n    util.createScalarValue(alpha as {} as 'float32', 'float32')]);\n\n  const program =\n  env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n  new\n  BinaryOpPackedProgram(LEAKYRELU_PACKED, x.shape, $alpha.shape) :\n  new\n  BinaryOpProgram(LEAKYRELU, x.shape, $alpha.shape);\n\n  const result = backend.runWebGLProgram(program,\n  [x, $alpha], x.dtype);\n\n  backend.disposeIntermediateTensorInfo($alpha);\n\n  return result;\n}\n\nexport const\nleakyReluConfig: KernelConfig = {\n  kernelName: LeakyRelu,\n  backendName: 'webgl',\n  kernelFunc: leakyRelu\n  as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
=====
*/\n\nimport {env, KernelConfig, KernelFunc, Prelu, PreluInputs, TensorInfo} from '@tensorflow/tfjs-\n  core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {BinaryOpProgram} from\n  '../binaryop_gpu';\nimport {BinaryOpPackedProgram} from '../binaryop_packed_gpu';\n\nexport const PRELU =\n  `return (a < 0.) ? b * a : a;`\n\nexport const PRELU_PACKED = `\n  vec4 aLessThanZero = vec4(lessThan(a,\n  vec4(0.)));\n  return (aLessThanZero * (b * a)) + ((vec4(1.0) - aLessThanZero) * a);`\n\n\nexport function

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prelu(args: {inputs: PreluInputs, backend: MathBackendWebGL}): TensorInfo {
  \n  const {inputs, backend} =
  args;\n  const {x, alpha} = inputs;\n  \n  const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS')
  ?\n  new BinaryOpPackedProgram(PRELU_PACKED, x.shape, alpha.shape) :\n  new
  BinaryOpProgram(PRELU, x.shape, alpha.shape);\n  return backend.runWebGLProgram(program, [x, alpha],
  x.dtype);\n}\n\nexport const preluConfig: KernelConfig = {\n  kernelName: Prelu,\n  backendName: 'webgl',\n  kernelFunc: prelu as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
  Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
  except in compliance with the License.\n * You may obtain a copy of the License at\n *
  http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport {backend_util, BinaryInputs, DataType, env, KernelFunc, TypedArray, UnaryInputs, upcastType}
  from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport
  {BinaryOpProgram} from './binaryop_gpu';\nimport {BinaryOpPackedProgram} from
  './binaryop_packed_gpu';\nimport {complex} from './kernels/Complex';\nimport {LEAKYRELU,
  LEAKYRELU_PACKED} from './kernels/LeakyRelu';\nimport {PRELU, PRELU_PACKED} from
  './kernels/Prelu';\nimport * as unary_op from './unaryop_gpu';\nimport {UnaryOpProgram} from
  './unaryop_gpu';\nimport * as unary_packed_op from './unaryop_packed_gpu';\nimport {UnaryOpPackedProgram}
  from './unaryop_packed_gpu';\nimport {SimpleBinaryKernelImplCPU, SimpleUnaryKernelImplCPU} from
  './shared';\n\nexport const CHECK_NAN_SNIPPET_UNARY = `if (isnan(x)) return x;`;\n\nexport const
  CHECK_NAN_SNIPPET_BINARY = `\n  if (isnan(a)) return a;\n  if (isnan(b)) return b;\n`;\n\nexport const
  CHECK_NAN_SNIPPET_BINARY_PACKED = `\n  result.r = isNaN.r > 0. ? NAN : result.r;\n  result.g = isNaN.g
  > 0. ? NAN : result.g;\n  result.b = isNaN.b > 0. ? NAN : result.b;\n  result.a = isNaN.a > 0. ? NAN :
  result.a;\n`;\n\ntype UnaryKernelFuncConfig = {\n  opSnippet: string,\n  packedOpSnippet?: string,\n
  cpuKernelImpl?: SimpleUnaryKernelImplCPU,\n  dtype?: DataType\n};\n\n/**\n * Template that creates a
  `KernelFunc` for unary ops.\n * @param opSnippet Op snippet to create `UnaryOpProgram`.\n * @param
  packedOpSnippet Op snippet to create `UnaryOpPackedProgram`.\n * @param dtype Optional. If set, the result has
  this dtype. Otherwise, the\n * result has the same dtype as the first input. This is mainly used in\n *
  comparison kernels, such as Equal, Less, Greater, etc.\n *\nexport function unaryKernelFunc(\n  {opSnippet,
  packedOpSnippet, cpuKernelImpl, dtype}: UnaryKernelFuncConfig): KernelFunc {\n  return ({inputs,
  backend}) => {\n    const {x} = inputs as UnaryInputs;\n    const webglBackend = backend as
  MathBackendWebGL;\n    \n    const $dtype = dtype || x.dtype;\n    if (webglBackend.shouldExecuteOnCPU([x]) &&
  cpuKernelImpl != null) {\n      const xData = webglBackend.texData.get(x.dataId);\n      const outValues =
  cpuKernelImpl(xData.values as TypedArray, $dtype);\n      return webglBackend.makeTensorInfo(x.shape, $dtype,
  outValues);\n    }\n    \n    const shouldUsePackedProgram =\n    env().getBool('WEBGL_PACK_UNARY_OPERATIONS') && packedOpSnippet != null;\n    let program:
  UnaryOpProgram|UnaryOpPackedProgram;\n    if (shouldUsePackedProgram) {\n      program = new
  UnaryOpPackedProgram(x.shape, packedOpSnippet);\n    } else {\n      program = new UnaryOpProgram(x.shape,
  opSnippet);\n    }\n    return webglBackend.runWebGLProgram(program, [x], $dtype);\n  };}\n\ntype
  BinaryKernelFuncConfig = {\n  opSnippet: string,\n  packedOpSnippet?: string,\n  checkOutOfBounds?: boolean,\n
  supportsComplex?: boolean,\n  cpuKernelImpl?: SimpleBinaryKernelImplCPU,\n  dtype?: DataType\n};\n\n/**\n *
  Template that creates a `KernelFunc` for binary ops.\n * @param opSnippet Op snippet to create
  `BinaryOpProgram`.\n * @param packedOpSnippet Op snippet to create `BinaryOpPackedProgram`.\n * @param
  checkOutOfBoundsForPackedProgram Whether to set checkOutOfBounds=true\n * when creating
  BinaryOpPackedProgram.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n *
  result has the same dtype as the first input. This is mainly used in\n * comparison kernels, such as Equal, Less, Greater,

```



```

const bSample = transposeB ? 'rc.z, i * 2' : 'i * 2, rc.z';\n  const aSwizzle = transposeA ? ['a.xxyy', 'a.zzww'] :
['a.xzzz', 'a.yyyw'];\n  const bSwizzle = transposeB ? ['b.xzxx', 'b.yyyw'] : ['b.xyxy', 'b.zzww'];\n\n  let
activationSnippet = ", applyActivationSnippet = ";\n  if (activation) {\n    if (hasPreluActivation) {\n
activationSnippet = `vec4 activation(vec4 a) {\n      vec4 b = getPreluActivationWeightsAtOutCoords();\n
${activation}\n    }`;
    } else if (hasLeakyreluActivation) {\n      activationSnippet = `vec4 activation(vec4 a)
{\n      vec4 b = getLeakyreluAlphaAtOutCoords();\n      ${activation}\n    }`;
    } else {\n      activationSnippet = `vec4 activation(vec4 x) {\n      ${activation}\n    }`;
    }\n\n    applyActivationSnippet = `result = activation(result);`;
  }\n\n  const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords()'; : ";\n
  if (addBias) {\n    this.variableNames.push('bias');\n  }\n\n  if (hasPreluActivation) {\n
this.variableNames.push('preluActivationWeights');\n  }\n\n  if (hasLeakyreluActivation) {\n
this.variableNames.push('leakyreluAlpha');\n  }\n\n  let batchASnippet = 'rc.x';\n  let batchBSnippet = 'rc.x';\n
  if (aShape[0] < bShape[0]) {\n    batchASnippet = `int(min(float(rc.x), ${aShape[0] - 1}))`;
  } else if
(bShape[0] < aShape[0]) {\n    batchBSnippet = `int(min(float(rc.x), ${bShape[0] - 1}))`;
  }\n\n  this.userCode
= `\n    ${activationSnippet}\n\n    const float sharedDimension = ${sharedDimensionPacked}.0;\n\n    vec4
dot2x2ARowBCol(ivec3 rc) {\n      vec4 result = vec4(0);\n      for (int i = 0; i < ${sharedDimensionPacked}; i++)
{\n        int batchA = ${batchASnippet};\n        int batchB = ${batchBSnippet};\n        vec4 a =
getMatrixA(batchA, ${aSample});\n        vec4 b = getMatrixB(batchB, ${bSample});\n\n        // These swizzled
products need to be separately added.\n        // See: https://github.com/tensorflow/tfjs/issues/1735\n        result +=
(${aSwizzle[0]} * ${bSwizzle[0]});\n        result += (${aSwizzle[1]} * ${bSwizzle[1]});\n      }\n      return
result;\n    }\n\n    void main() {\n      ivec3 rc = getOutputCoords();\n      vec4 result =
dot2x2ARowBCol(rc);\n\n      ${addBiasSnippet}\n      ${applyActivationSnippet}\n\n      setOutput(result);\n
    }\n  `;\n  }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\n//
(Ar + Ai)(Br + Bi) =\n// ArBr + ArBi + AiBr + AiBi = ArBr - AB + ArBi + AiBr\n// Yr = ArBr - AB\n// Yi = ArBi
+ AiBr\n\nexport const COMPLEX_MULTIPLY = {\n  REAL: 'return areal * breal - aimag * bimag;',\n  IMAG:
'return areal * bimag + aimag * breal;'\n};\n\nexport class BinaryOpComplexProgram implements GPGPUProgram
{\n  variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];\n  userCode: string;\n  outputShape: number[];\n\n  constructor(op: string, aShape: number[], bShape: number[]) {\n    this.outputShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n    this.userCode = `\n    float
binaryOpComplex(\n      float areal, float aimag, float breal, float bimag) {\n      ${op}\n    }\n\n    void main()
{\n      float areal = getARealAtOutCoords();\n      float aimag = getAImagAtOutCoords();\n      float breal =
getBRealAtOutCoords();\n      float bimag = getBImagAtOutCoords();\n      setOutput(binaryOpComplex(areal,
aimag, breal, bimag));\n    }\n  `;\n  }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from

```

```

'./backend_webgl';\nimport {ReshapePackedProgram} from './reshape_packed_gpu';\nimport {getBatchDim,
getRowsCols} from './webgl_util';\n\nexport function packedReshape(\n  input: TensorInfo, afterShape:
number[],\n  backend: MathBackendWebGL): TensorInfo {\n  const input3DShape =\n[getBatchDim(input.shape),\n  ...getRowsCols(input.shape)] as [number, number, number];\n  const input3D:
TensorInfo = {\n  dtype: input.dtype,\n  shape: input3DShape,\n  dataId: input.dataId\n };;\n  const
afterShapeAs3D =\n  [getBatchDim(afterShape),\n  ...getRowsCols(afterShape)] as [number, number,
number];;\n\n  const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n  const
preventEagerUnpackingOfOutput = true;\n  const output = backend.runWebGLProgram(\n    program, [input3D],
input.dtype, null /* customSetup */,\n    preventEagerUnpackingOfOutput);\n  return {dataId: output.dataId, shape:
afterShape, dtype: output.dtype};;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {packedReshape}
from './kernel_utils/reshape';\nimport {isReshapeFree} from './webgl_util';\n\nexport function reshape(args: {\n
inputs: ReshapeInputs,\n  backend: MathBackendWebGL,\n  attrs: ReshapeAttrs\n}): TensorInfo {\n  const {inputs,
backend, attrs} = args;\n  const {x} = inputs;\n  const {shape} = attrs;\n  const webglBackend = backend;\n\n  const
xSize = util.sizeFromShape(x.shape);\n  const $shape = util.inferFromImplicitShape(shape, xSize);\n  const $xSize
= util.sizeFromShape($shape);\n\n  util.assert(\n    xSize === $xSize,\n    () => `The new shape (${ $shape }) has
${ $xSize } elements and the old ` +\n      `shape (${ x.shape }) has ${ xSize } elements. The new shape and old ` +\n
      `shape must have the same number of elements.`);\n\n  const xTexData =
webglBackend.texData.get(x.dataId);\n  if (xTexData.isPacked && !isReshapeFree(x.shape, $shape) &&\n
!(xTexData.texture !== null && isReshapeFree(xTexData.shape, $shape))) {\n    return packedReshape(x, $shape,
webglBackend);\n  }\n\n  webglBackend.incRef(x.dataId);\n  return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};;\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName:
'webgl',\n  kernelFunc: reshape as {} as KernelFunc\n};;\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class MeanProgram implements GPGPUProgram {\n  variableNames = ['x'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(reduceInfo: backend_util.ReduceInfo, divisor?:
number) {\n    const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n    this.outputShape = [batchSize,
outSize];\n    const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n    const
windowSizeVec4Remainder = windowSize % 4;\n\n    let updateSnippet = `sumValue += dot(values, ones);`\n    if
(divisor !== null) {\n      const denominator = 1 / divisor;\n      updateSnippet = `sumValue += dot(values * ${\n
util.isInt(denominator) ? denominator.toPrecision(2) :\n      denominator}, ones);`\n    }\n\n    let
checkOutOfBounds = `;\n    if (inSize % windowSize > 0) {\n      checkOutOfBounds = `\n      if (inIdx < 0 || inIdx
>= ${inSize}) {\n        return 0.0;\n      }\n    `;\n  }\n\n  this.userCode = `\n    const vec4 ones = vec4(1.0,

```



```

float sumValue = 0.0;\n    float allValue = 1.0;\n    float anyValue = 0.0;\n\n    for (int i = 0; i <
${windowSizeNearestVec4}; i += 4) {\n        int inIdx = inOffset + i;\n        ${vecType} values = ${vecType}(\n
            getValue(batch, inIdx),\n            getValue(batch, inIdx + 1),\n            getValue(batch, inIdx + 2),\n            getValue(batch, inIdx + 3)\n        );\n\n        ${updateSnippet}\n    }\n\n    int inIdx = inOffset +
${windowSizeNearestVec4};\n    if (${windowSizeVec4Remainder === 1}) {\n        ${vecType} values =
${vecType}(\n            getValue(batch, inIdx),\n            initializationValue,\n            initializationValue,\n            initializationValue\n        );\n\n        ${updateSnippet}\n    } else if (${windowSizeVec4Remainder === 2}) {\n
        ${vecType} values = ${vecType}(\n            getValue(batch, inIdx),\n            getValue(batch, inIdx + 1),\n            initializationValue,\n            initializationValue\n        );\n\n        ${updateSnippet}\n    } else if
(${windowSizeVec4Remainder === 3}) {\n        ${vecType} values = ${vecType}(\n            getValue(batch,
inIdx),\n            getValue(batch, inIdx + 1),\n            getValue(batch, inIdx + 2),\n            initializationValue\n
        );\n\n        ${updateSnippet}\n    }\n    setOutput(${returnValue});\n }\n `;\n }\n }\n\n", "/*\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {backend_util, DataType, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {MeanProgram} from '../mean_gpu';\n\nimport
{ReduceProgram} from '../reduce_gpu';\n\nntype ReduceTypes = 'all'|'any'|'max'|'min'|'sum'|'prod'|'mean';\n\n//
Returns an array of configuration objects that describe each stage of the\n// reduction.\n\nfunction
getReductionStages(inShape: number[]):\n    Array<{inSize: number, windowSize: number, outSize: number}> {\n
    const stages = [];\n\n    while (stages.length === 0 || stages[stages.length - 1].outSize !== 1) {\n        const outSize:
number =\n            stages.length ? stages[stages.length - 1].outSize : inShape[1];\n        const windowSize =
backend_util.computeOptimalWindowSize(outSize);\n        stages.push({\n            inSize: outSize,\n            windowSize,\n
            outSize: Math.ceil(outSize / windowSize)\n        });\n    }\n\n    return stages;\n}\n\n\nexport function reduce(\n    x:
TensorInfo, dtype: DataType, reductionType: ReduceTypes,\n    backend: MathBackendWebGL): TensorInfo {\n
    const reductionStages = getReductionStages(x.shape);\n\n    let result = x;\n    for (let i = 0; i < reductionStages.length;\n
i++) {\n        const {inSize, windowSize, outSize} = reductionStages[i];\n        let program:
ReduceProgram|MeanProgram;\n        let previousResult: TensorInfo;\n        if (reductionType === 'mean') {\n
            program = i === 0 ?\n                new MeanProgram(\n                    {windowSize, inSize, batchSize: x.shape[0], outSize},\n
                    inSize)\n                :\n                new MeanProgram({windowSize, inSize, batchSize: x.shape[0], outSize});\n            }\n        }\n        else {\n            program = new ReduceProgram(\n                {windowSize, inSize, batchSize: x.shape[0], outSize},\n                reductionType);\n            }\n        }\n        previousResult = result;\n        result = backend.runWebGLProgram(program, [result], dtype);\n\n        if
(previousResult.dataId !== x.dataId) {\n            backend.disposeIntermediateTensorInfo(previousResult);\n        }\n    }\n\n    return result;\n}\n\n", "/*\n * @license\n
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nimport {getCoordsDataType} from
'/shader_compiler';\n\n\nexport class TransposeProgram implements GPGPUProgram {\n    variableNames = ['A'];\n
    outputShape: number[];\n    userCode: string;\n    rank: number;\n\n    constructor(aShape: number[], newDim:

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number[]) {\n  const outputShape: number[] = new Array(aShape.length);\n  for (let i = 0; i < outputShape.length;\n  i++) {\n    outputShape[i] = aShape[newDim[i]];\n  }\n  this.outputShape = outputShape;\n  this.rank =\n  outputShape.length;\n  const dtype = getCoordsDataType(this.rank);\n  const switched =\n  getSwitchedCoords(newDim);\n\n  this.userCode = `\n  void main() {\n    ${dtype} resRC =\n    getOutputCoords();\n    setOutput(getA(${switched}));\n  }\n  `;\n}\n\nfunction\ngetSwitchedCoords(newDim: number[]): string {\n  const rank = newDim.length;\n  if (rank > 6) {\n    throw\n    Error(`Transpose for rank ${rank} is not yet supported`);\n  }\n  const originalOrder =\n    ['resRC.x', 'resRC.y',\n    'resRC.z', 'resRC.w', 'resRC.u', 'resRC.v'];\n  const switchedCoords = new Array(rank);\n  for (let i = 0; i <\n  newDim.length; i++) {\n    switchedCoords[newDim[i]] = originalOrder[i];\n  }\n  return\n  switchedCoords.join();\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getVecChannels} from './packing_util';\nimport\n{getCoordsDataType} from './shader_compiler';\n\nexport class TransposePackedProgram implements\nGPGPUProgram {\n  variableNames = ['A'];\n  outputShape: number[];\n  userCode: string;\n  rank: number;\n  packedInputs = true;\n  packedOutput = true;\n\n  constructor(aShape: number[], newDim: number[]) {\n    const\n    outputShape: number[] = new Array(aShape.length);\n    for (let i = 0; i < outputShape.length; i++) {\n\n    outputShape[i] = aShape[newDim[i]];\n    }\n    this.outputShape = outputShape;\n    this.rank =\n    outputShape.length;\n    if (this.rank > 6) {\n      throw Error(`\n      Packed transpose for rank ${this.rank} is not\n      yet supported.`);\n    }\n    const dtype = getCoordsDataType(this.rank);\n    const outputOrder =\n    getVecChannels('rc', this.rank);\n    const switchedOrder = new Array(this.rank);\n    for (let i = 0; i <\n    newDim.length; i++) {\n      switchedOrder[newDim[i]] = outputOrder[i];\n    }\n    const innerDims =\n    `vec2(${switchedOrder.slice(-2).join()})`;\n    const nextColumn =\n    `++${outputOrder[this.rank - 1]} <\n    ${outputShape[this.rank - 1]}`;\n    const getc = `getChannel(getA(${switchedOrder.join()}), ${innerDims})`;\n\n    this.userCode = `\n    void main() {\n      ${dtype} rc = getOutputCoords();\n      vec4 result = vec4(0.);\n      result[0] = ${getc};\n      if (${nextColumn}) {\n        result[1] = ${getc};\n      }\n      --${outputOrder[this.rank -\n      1]};\n      if (++${outputOrder[this.rank - 2]} < ${outputShape[this.rank - 2]}) {\n        result[2] = ${getc};\n      }\n      if (${nextColumn}) {\n        result[3] = ${getc};\n      }\n      setOutput(result);\n    }\n    `;\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util, sumOutType, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n{MathBackendWebGL} from '../backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\nimport {reshape}\nfrom './Reshape';\nimport {transposeImpl} from './Transpose_impl';\n\nexport function sumImpl(\n  x:\n  TensorInfo, axis: number|number[], keepDims: boolean,\n  backend: MathBackendWebGL): TensorInfo {\n  const\n  reductionIndices = axis;\n  const xRank = x.shape.length;\n  const origAxes =\n  util.parseAxisParam(reductionIndices, x.shape);\n  let axes = origAxes;\n  const permutedAxes =\n  backend_util.getAxesPermutation(axes, xRank);\n  const sumInputIsTransposed = permutedAxes !== null;\n  let\n  sumInput = x;\n  if (sumInputIsTransposed) {\n    sumInput = transposeImpl(x, permutedAxes, backend);\n  }\n  axes

```



```

= backend_util.getInnerMostAxes(axes.length, xRank);\n } \n\n backend_util.assertAxesAreInnerMostDims('sum',
axes, xRank);\n const [sumOutShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(sumInput.shape, axes);\n\n let outShape = sumOutShape;\n if
(keepDims) {\n // rather than reshape at the end, set the target shape here.\n outShape =
backend_util.expandShapeToKeepDim(sumOutShape, origAxes);\n } \n\n const inSize =
util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize /
inSize;\n const reshapedInput = reshape(\n {inputs: {x: sumInput}, attrs: {shape: [batchSize, inSize]},
backend});\n\n const outType = sumOutType(x.dtype);\n\n const reduced = reduce(reshapedInput, outType, 'sum',
backend);\n const out =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape}, backend});\n\n
backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n if
(sumInputIsTransposed) {\n backend.disposeIntermediateTensorInfo(sumInput);\n } \n\n return out;\n } \n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {sumImpl} from './Sum_impl';\n\nexport function
sum(\n args: {inputs: SumInputs, attrs: SumAttrs, backend: MathBackendWebGL}) {\n const {inputs, backend,
attrs} = args;\n\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n return sumImpl(x, axis, keepDims,
backend);\n }\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'webgl',\n
kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util, TensorInfo, upcastType, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {mapActivationToShaderProgram} from
 '../kernel_utils/kernel_funcs_utils';\n\nimport {MatMulPackedProgram} from './mulmat_packed_gpu';\n\nimport
{multiply} from './Multiply';\n\nimport {reshape} from './Reshape';\n\nimport {sum} from './Sum';\n\nimport {transpose}
from './Transpose';\n\n// Empirically determined minimal shared dimension in matmul before we forward\n// to
a.mul(b).sum() in order to take advantage of GPU parallelism. See\n// https://github.com/tensorflow/tfjs-
core/pull/1379 for benchmarks.\n\nexport const MATMUL_SHARED_DIM_THRESHOLD = 1000;\n\nntype
BatchMatMulConfig = {\n a: TensorInfo,\n b: TensorInfo,\n transposeA: boolean,\n transposeB: boolean,\n
backend: MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?:
number,\n activation?: backend_util.Activation\n};\n\nexport function batchMatMulImpl({\n a,\n b,\n
transposeA,\n transposeB,\n backend,\n bias = null,\n preluActivationWeights = null,\n leakyreluAlpha = 0,\n
activation = null\n}: BatchMatMulConfig): TensorInfo {\n const aRank = a.shape.length;\n const bRank =
b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const

```

```

batchDimsCompatible =\n    batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\nutil.assert(\n    aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n    () => `Error in matMul: the input\n    batch dimensions must either be the `+\n        `same or at least one input batch dimension must be 1. Got input `+\n        `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\nconst outShapeOuterDims =\n    batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\nconst outShape =\n    outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\nutil.assert(\n    innerShapeA === innerShapeB,\n    () => `Error in matMul: inner shapes (${innerShapeA}) and `+\n        `${innerShapeB}` of Tensors with shapes\n    ${a.shape} and `+\n        `${b.shape} and transposeA=${transposeA}` `+\n        ` and transposeB=${transposeB}`\n    must match.`);\n\nconst a3dShape: [number, number, number] = transposeA ?\n    [batchDimA, innerShapeA,\n    outerShapeA] :\n    [batchDimA, outerShapeA, innerShapeA];\nconst b3dShape: [number, number, number] =\n    transposeB ?\n    [batchDimB, outerShapeB, innerShapeB] :\n    [batchDimB, innerShapeB, outerShapeB];\n\n// The rest of the implementation is designed to operate on rank-3 tensors\nconst a3d = reshape({inputs: {x: a},\n    backend, attrs: {shape: a3dShape}});\nconst b3d = reshape({inputs: {x: b}, backend, attrs: {shape:\n    b3dShape}});\nconst intermediates: TensorInfo[] = [a3d, b3d];\nconst batchDim = Math.max(batchDimA,\n    batchDimB);\nconst sharedDim = transposeA ? a3d.shape[1] : a3d.shape[2];\nconst hasBias = bias != null;\nconst hasPreluActivationWeights = preluActivationWeights != null;\nconst hasLeakyreluAlpha = activation ===\n    'leakyrelu';\nconst fusedActivation = activation != null ?\n    mapActivationToShaderProgram(activation, true) :\n    null;\nconst containsFusedOps = hasBias || hasPreluActivationWeights ||\n    hasLeakyreluAlpha ||\n    fusedActivation != null;\nlet out: TensorInfo;\n\n// Since the matrices are vectors, it is faster to call mul().sum()\n// because sum() is O(sqrt(N)) due to divide-and-conquer.\nif ((outerShapeA === 1 || outerShapeB === 1) &&\n    sharedDim > MATMUL_SHARED_DIM_THRESHOLD && containsFusedOps === false) {\n    let aVec = a3d;\n    let bVec = b3d;\n    if (transposeA) {\n        aVec = transpose({inputs: {x: a3d}, backend, attrs: {perm: [0, 2, 1]}});\n        intermediates.push(aVec);\n    }\n    if (transposeB) {\n        bVec = transpose({inputs: {x: b3d}, backend, attrs:\n        {perm: [0, 2, 1]}});\n        intermediates.push(bVec);\n    }\n\n    const shouldReshapeA = outerShapeB !== 1;\n    const shouldReshapeB = outerShapeB === 1;\n\n    let aVec3d = aVec;\n    if (shouldReshapeA) {\n        aVec3d = reshape({\n            inputs: {x: aVec},\n            backend,\n            attrs: {shape: [batchDim, sharedDim, 1]}\n        });\n        intermediates.push(aVec3d);\n    }\n\n    const axis = outerShapeB === 1 ? 2 : 1;\n    let bVec3d = bVec;\n    if (shouldReshapeB) {\n        bVec3d = reshape({\n            inputs: {x: bVec},\n            backend,\n            attrs: {shape:\n            [batchDim, 1, sharedDim]}\n        });\n        intermediates.push(bVec3d);\n    }\n\n    const product =\n    multiply({inputs: {a: aVec3d, b: bVec3d}, backend});\n    out = sum({inputs: {x: product}, backend, attrs: {axis,\n    keepDims: true}});\n    intermediates.push(product);\n} else {\n    const dtype = upcastType(a.dtype, b.dtype);\n    const program = new MatMulPackedProgram(\n        a3dShape, b3dShape, [batchDim, outerShapeA, outerShapeB],\n        transposeA,\n        transposeB, hasBias, fusedActivation, hasPreluActivationWeights,\n        hasLeakyreluAlpha);\n    const inputs: TensorInfo[] = [a3d, b3d];\n    if (bias != null) {\n        inputs.push(bias);\n    }\n    if (hasPreluActivationWeights) {\n        inputs.push(reluActivationWeights);\n    }\n    if (hasLeakyreluAlpha)\n    {\n        const $leakyreluAlpha = backend.makeTensorInfo(\n            [], 'float32',\n            util.createScalarValue(leakyreluAlpha as {} as 'float32', 'float32'));\n        inputs.push($leakyreluAlpha);\n        intermediates.push($leakyreluAlpha);\n    }\n\n    out = backend.runWebGLProgram(program, inputs, dtype);\n}\n\nconst outReshaped =\n    reshape({inputs: {x: out}, backend, attrs: {shape: outShape}});\nintermediates.push(out);\nfor (const i of intermediates) {\n    backend.disposeIntermediateTensorInfo(i);\n}\nreturn outReshaped;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
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*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { batchMatMulImpl }
from './BatchMatMul_impl';\n\nexport function _fusedMatMul(args: { \n inputs: _FusedMatMulInputs,\n attrs:
_FusedMatMulAttrs,\n backend: MathBackendWebGL\n }) { \n const { inputs, backend, attrs } = args;\n const { a, b,
bias, preluActivationWeights } = inputs;\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n\n
return batchMatMulImpl({ \n a,\n b,\n transposeA,\n transposeB,\n backend,\n bias,\n
preluActivationWeights,\n leakyreluAlpha,\n activation\n });\n}\n\nexport const _fusedMatMulConfig:
KernelConfig = { \n kernelName: _FusedMatMul,\n backendName: 'webgl',\n kernelFunc: _fusedMatMul as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport { Acos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\nimport { CHECK_NAN_SNIPPET } from '../unaryop_gpu';\n\nconst ACOS =
CHECK_NAN_SNIPPET + ` \n if (abs(x) > 1.) { \n   return NAN;\n } \n return acos(x); \n `;\n\nexport const acos =
unaryKernelFunc({ opSnippet: ACOS });\n\nexport const acosConfig: KernelConfig = { \n kernelName: Acos,\n backendName: 'webgl',\n kernelFunc: acos,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport { Acosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\nimport { CHECK_NAN_SNIPPET } from '../unaryop_gpu';\n\nconst ACOSH =
CHECK_NAN_SNIPPET + ` \n if (x < 1.0) return NAN;\nreturn log(x + sqrt(x * x - 1.0)); \n `;\n\nexport const acosh =
unaryKernelFunc({ opSnippet: ACOSH });\n\nexport const acoshConfig: KernelConfig = { \n kernelName: Acosh,\n backendName: 'webgl',\n kernelFunc: acosh,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class AddNProgram implements GPGPUProgram
{ \n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(outputShape:
number[], shapes: number[][] ) { \n this.outputShape = outputShape;\n this.variableNames = shapes.map((_, i) =>
`T${i}`);\n\n const snippets: string[] = [];\n // Get target elements from every input tensor.\n
this.variableNames.forEach(variable => { \n snippets.push(`float v${variable} =
get${variable}AtOutCoords();`);\n });\n\n // Calculate the sum of all elements.\n const operation =
this.variableNames\n .map(variable => { \n return `v${variable}`;\n })\n .join(' + ');\n\n this.userCode = ` \n void main() { \n
${snippets.join("\n ")}\n\n

```

```
float result = ${operation};\n    setOutput(result);\n    }\n    `;\n    }\n}\n\n",/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class AddNPackedProgram implements\nGPGPUProgram {\n  variableNames: string[];\n  outputShape: number[] = [];\n  userCode: string;\n  packedInputs =\ntrue;\n  packedOutput = true;\n\n  constructor(outputShape: number[], shapes: number[][]) {\n    this.outputShape =\noutputShape;\n    this.variableNames = shapes.map((_, i) => `T${i}`);\n\n    const snippets: string[] = [];\n    // Get\n    target elements from every input tensor.\n    this.variableNames.forEach(variable => {\n      snippets.push(`vec4\nv${variable} = get${variable}AtOutCoords();`);\n    });\n\n    // Calculate the sum of all elements.\n    const\n    operation = this.variableNames\n      .map(variable => {\n        return `v${variable}`;\n      })\n      .join(' + ');\n\n    this.userCode = `\n    void main() {\n      ${snippets.join("\n")}\n      vec4 result = ${operation};\n      setOutput(result);\n    }\n    `;\n  }\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {AddN, AddNInputs, env, KernelConfig, KernelFunc, TensorInfo, upcastType} from\n '@tensorflow/tfjs-core';\nimport {AddNProgram} from './addn_gpu';\nimport {AddNPackedProgram} from\n './addn_packed_gpu';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {identity} from\n './Identity';\n\nexport function addN(args: {inputs: AddNInputs, backend: MathBackendWebGL}):\n TensorInfo\n {\n  const {inputs, backend} = args;\n  const tensors = inputs;\n  if (tensors.length === 1) {\n    return\n    identity({inputs: {x: tensors[0]}, backend});\n  }\n\n  // Limit the number of uploaded textures for optimization.\n  if (tensors.length > env().get('WEBGL_MAX_TEXTURES_IN_SHADER')) {\n    const midIndex =\n    Math.floor(tensors.length / 2);\n    const leftSide = addN({inputs: tensors.slice(0, midIndex), backend});\n    const\n    rightSide = addN({inputs: tensors.slice(midIndex), backend});\n    return addN({inputs: [leftSide, rightSide],\n    backend});\n  }\n\n  const dtype =\n    tensors.map(t => t.dtype).reduce((d1, d2) => upcastType(d1, d2));\n  const\n  shapes = tensors.map(t => t.shape);\n  // We can make sure shapes are identical in op level.\n  const usePackedOp =\n    env().getBool('WEBGL_PACK');\n  const program = usePackedOp ?\n    new\n    AddNPackedProgram(tensors[0].shape, shapes) :\n    new AddNProgram(tensors[0].shape, shapes);\n  return\n    backend.runWebGLProgram(program, tensors, dtype);\n}\n\n\nexport const addNConfig: KernelConfig = {\n  kernelName: AddN,\n  backendName: 'webgl',\n  kernelFunc: addN as { } as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce} from
```

```

'./kernel_utils/reduce';\n\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nexport
function all(\n  args: {inputs: AllInputs, backend: MathBackendWebGL, attrs: AllAttrs});\n  TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n const xRank =
x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n if (permutedAxes != null)
{\n  permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n  axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n } \n\n backend_util.assertAxesAreInnerMostDims('all',
axes, xRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =
util.sizeFromShape(reduceShape);\n\n const a2D =\n  reshape({inputs: {x: permutedX}, backend, attrs: {shape:
[-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'all', backend);\n\n let res;\n if (keepDims) {\n const
newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n  res = reshape({inputs: {x: reduced},
backend, attrs: {shape: newShape}});\n } else {\n  res = reshape({inputs: {x: reduced}, backend, attrs: {shape:
outShape}});\n } \n\n backend.disposeIntermediateTensorInfo(a2D);\n
backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes != null) {\n
backend.disposeIntermediateTensorInfo(permutedX);\n } \n\n return res;\n}\n\nexport const allConfig:
KernelConfig = {\n kernelName: All,\n backendName: 'webgl',\n kernelFunc: all as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reduce} from
'./kernel_utils/reduce';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nexport
function any(\n  args: {inputs: AnyInputs, backend: MathBackendWebGL, attrs: AnyAttrs});\n  TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, keepDims} = attrs;\n\n const xRank =
x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n if (permutedAxes != null)
{\n  permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n  axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n } \n\n backend_util.assertAxesAreInnerMostDims('any',
axes, xRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =
util.sizeFromShape(reduceShape);\n\n const a2D =\n  reshape({inputs: {x: permutedX}, backend, attrs: {shape:
[-1, inSize]}});\n const reduced = reduce(a2D, a2D.dtype, 'any', backend);\n\n let res;\n if (keepDims) {\n const
newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n  res = reshape({inputs: {x: reduced},
backend, attrs: {shape: newShape}});\n } else {\n  res = reshape({inputs: {x: reduced}, backend, attrs: {shape:
outShape}});\n } \n\n backend.disposeIntermediateTensorInfo(a2D);\n
backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes != null) {\n
backend.disposeIntermediateTensorInfo(permutedX);\n } \n\n return res;\n}\n\nexport const anyConfig:
KernelConfig = {\n kernelName: Any,\n backendName: 'webgl',\n kernelFunc: any as { } as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

```

on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ArgMinMaxProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(\n    reduceInfo: backend_util.ReduceInfo, op: 'max'|'min',\n    firstPass: boolean) {\n    const {windowSize, batchSize, outSize} = reduceInfo;\n    if (!firstPass) {\n      this.variableNames.push('bestIndicesA');\n    }\n    this.outputShape = [batchSize, outSize];\n    const compOp = (op === 'max') ? '>' : '<';\n    const indexSnippet = firstPass ? 'inOffset + i;'\n    : 'round(getBestIndicesA(batch, inOffset + i));'\n    this.userCode = `\n    void main() {\n      ivec2 coords = getOutputCoords();\n      int batch = coords[0];\n      int outIdx = coords[1];\n      int inOffset = outIdx * ${windowSize};\n      int bestIndex = inOffset;\n      float bestValue = getA(batch, bestIndex);\n      for (int i = 0; i < ${windowSize}; i++) {\n        int inIdx = ${indexSnippet};\n        float candidate = getA(batch, inIdx);\n        if (candidate ${compOp} bestValue) {\n          bestValue = candidate;\n          bestIndex = inIdx;\n        }\n      }\n      setOutput(float(bestIndex));\n    }\n  `;\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class ArgMinMaxPackedProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  outputShape: number[];\n  userCode: string;\n  packedInputs = true;\n  packedOutput = true;\n\n  constructor(\n    shape: number[],\n    windowSize: number, op: 'max'|'min',\n    firstPass: boolean) {\n    util.assert(shape.length > 2, () =>`\n    Packed arg${op.charAt(0).toUpperCase()}${op.slice(1)} supports only inputs with rank above 2.`);\n    const inSize = shape[shape.length - 1];\n    const outSize = Math.ceil(inSize / windowSize);\n    this.outputShape = shape.slice(0, -1);\n    if (outSize > 1) {\n      this.outputShape.push(outSize);\n    }\n    if (!firstPass) {\n      this.variableNames.push('bestIndicesA');\n    }\n    const outShape = this.outputShape;\n    const rank = outShape.length;\n    const dtype = getCoordsDataType(rank);\n    const coords = getChannels('coords', rank);\n    let sourceLocSetup;\n    let sourceRank;\n    if (outSize === 1) {\n      sourceRank = rank + 1;\n      const sourceLocDType = getCoordsDataType(sourceRank);\n      sourceLocR = ${sourceLocDType}(${coords.join()}), 0);\n      sourceLocG = ${sourceLocDType}(${coords.join()}), 0);\n      sourceLocA = ${sourceLocDType}(${coords.join()}), 0);\n      sourceLocB = ${sourceLocDType}(${coords.join()}), 0);\n    } else {\n      sourceRank = rank;\n      sourceLocSetup = `\n      ${dtype} sourceLocR = coords;\n      ++${coords[rank - 1]};\n      ${dtype} sourceLocG = coords;\n      ++${coords[rank - 2]};\n      ${dtype} sourceLocA = coords;\n      --${coords[rank - 1]};\n      ${dtype} sourceLocB = coords;\n      --${coords[rank - 2]};\n    `;\n    }\n    const channels = ['x', 'y', 'z', 'w', 'u', 'v'].slice(0, sourceRank);\n    const inChannel = '.' + channels[sourceRank - 1]; // e.g. \".b\" for rank 3.\n    const intChannels = channels.map(x => `int ` + x);\n    const srcRCoords =\n      getChannels('sourceLocR', sourceRank - 1).concat(`inIdx.r`);\n    const srcGCoords =\n      getChannels('sourceLocG', sourceRank - 1).concat(`inIdx.g`);\n    const srcBCoords =\n      getChannels('sourceLocB', sourceRank - 1).concat(`inIdx.b`);\n    const srcACoords =\n      getChannels('sourceLocA', sourceRank - 1).concat(`inIdx.a`);\n    const compOp = (op === 'max') ? 'greaterThan' :
```

```

'lessThan';\n  const fetchCandidateIdx = firstPass ? " : "\n      inIdx =
round(vec4(getBestIndicesAChannel(${srcRCoords.join()}),\n
getBestIndicesAChannel(${srcGCoords.join()}),\n
getBestIndicesAChannel(${srcBCoords.join()}),\n
getBestIndicesAChannel(${srcACoords.join()}));\n\n  const fetchValue = `vec4(\n
getAChannel(${srcRCoords.join()}),\n      hasNextCol ? getAChannel(${srcGCoords.join()}) : 0.,\n
hasNextRow ? getAChannel(${srcBCoords.join()}) : 0.,\n      hasNextRow && hasNextCol ?
getAChannel(${srcACoords.join()}) : 0.`;\n\n  const getBestIndicesAChannelSnippet = firstPass ? " : "\n  float
getBestIndicesAChannel(${intChannels.join()}) {\n      return getChannel(getBestIndicesA(${channels.join()}),\n
vec2(${channels.slice(-2).join()}));\n  };\n\n  this.userCode = `\n  float
getAChannel(${intChannels.join()}) {\n      return getChannel(getA(${channels.join()}),\n
vec2(${channels.slice(-2).join()}));\n  }\n  ${getBestIndicesAChannelSnippet}\n  void main() {\n
${dtype} coords = getOutputCoords();\n      bool hasNextCol = ${coords[rank - 1]} < ${outShape[rank - 1] - 1};\n
      bool hasNextRow = ${coords[rank - 2]} < ${outShape[rank - 2] - 1};\n      ${sourceLocSetup}\n      ivec4
srcIdx = ivec4(sourceLocR${inChannel}, sourceLocG${inChannel},\n      sourceLocB${inChannel},
sourceLocA${inChannel}) * ${windowSize};\n      ivec4 inIdx = srcIdx;\n      vec4 bestIndex = vec4(inIdx);\n
vec4 bestValue = ${fetchValue};\n\n      for (int i = 0; i < ${windowSize}; i++) {\n          inIdx = srcIdx;\n
${fetchCandidateIdx}\n          vec4 candidate = ${fetchValue};\n          bvec4 nan = isnan(candidate);\n          bvec4
replace = bvec4(\n              vec4(${compOp}(candidate, bestValue)) * (vec4(1.0) - vec4(nan));\n\n              bestValue =
vec4(replace.x ? candidate.x : bestValue.x,\n                  replace.y ? candidate.y : bestValue.y,\n
                  replace.z ? candidate.z : bestValue.z,\n                  replace.w ? candidate.w : bestValue.w);\n          bestIndex
= mix(bestIndex, vec4(inIdx), vec4(replace));\n          srcIdx++;\n          }\n      setOutput(bestIndex);\n  }\n  `;\n
}\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, env, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {ArgMinMaxProgram}
from './argminmax_gpu';\nimport {ArgMinMaxPackedProgram} from './argminmax_packed_gpu';\nimport
{MathBackendWebGL} from './backend_webgl';\nimport {reshape} from './kernels/Reshape';\n\nfunction
argReduce(\n  backend: MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',\n  bestIndicesA:
TensorInfo = null): TensorInfo {\n  let batchSize = x.shape[0];\n  let inSize = x.shape[1];\n  if (bestIndicesA != null)
{\n    batchSize = bestIndicesA.shape[0];\n    inSize = bestIndicesA.shape[1];\n  }\n  const windowSize =
backend_util.computeOptimalWindowSize(inSize);\n  const reduceInfo =\n    {windowSize, inSize, batchSize,
outSize: Math.ceil(inSize / windowSize)};\n  const program =\n    new ArgMinMaxProgram(reduceInfo,
reduceType, bestIndicesA == null);\n  const inputs = [x];\n  if (bestIndicesA != null) {\n
inputs.push(bestIndicesA);\n  }\n  const output = backend.runWebGLProgram(program, inputs, 'int32');\n  // No
need to run another GPGPU program.\n  if (output.shape[1] === 1) {\n    return output;\n  }\n  const result =
argReduce(backend, x, reduceType, output);\n  backend.disposeIntermediateTensorInfo(output);\n  return
result;\n}\n\nfunction argReducePacked(\n  backend: MathBackendWebGL, x: TensorInfo, reduceType:
'max'|'min',\n  bestIndicesA: TensorInfo = null): TensorInfo {\n  const inShape = bestIndicesA != null ?
bestIndicesA.shape : x.shape;\n  const inSize = inShape[inShape.length - 1];\n  const windowSize =
backend_util.computeOptimalWindowSize(inSize);\n  const program = new ArgMinMaxPackedProgram(\n
inShape, windowSize, reduceType, bestIndicesA == null);\n  const inputs = bestIndicesA == null ? [x] : [x,
bestIndicesA];\n  const output = backend.runWebGLProgram(program, inputs, 'int32');\n  if (output.shape.length
=== x.shape.length) {\n    const result = argReducePacked(backend, x, reduceType, output);\n

```

```

backend.disposeIntermediateTensorInfo(output);\n  return result;\n }\n return output;\n}\n\nexport function
argMinMaxReduce(\n  backend: MathBackendWebGL, x: TensorInfo, axis: number,\n  reduceType: 'min'|'max'):\n  TensorInfo {\n    const axes = [axis];\n    backend_util.assertAxesAreInnerMostDims(\n      'arg' +
reduceType.charAt(0).toUpperCase() + reduceType.slice(1), axes,\n      x.shape.length);\n    if
(!env().getBool('WEBGL_PACK_REDUCE') || x.shape.length <= 2) {\n      const intermediateTensorInfos = [];\n      const [outShape, reduceShape] =\n        backend_util.computeOutAndReduceShapes(x.shape, axes);\n      const inSize
= util.sizeFromShape(reduceShape);\n      const a2D = reshape({inputs: {x}, backend, attrs: {shape: [-1, inSize]}});\n      intermediateTensorInfos.push(a2D);\n      const reduced = argReduce(backend, a2D, reduceType);\n      intermediateTensorInfos.push(reduced);\n      const reshaped =\n        reshape({inputs: {x: reduced}, backend, attrs:
{shape: outShape}});\n      intermediateTensorInfos.forEach(\n        t =>
backend.disposeIntermediateTensorInfo(t);\n      return reshaped;\n    }\n    return argReducePacked(backend, x,
reduceType);\n  }\n  ,"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{argMinMaxReduce} from '../kernel_utils/arg_min_max';\n\nimport {transpose} from './Transpose';\n\nexport
function argMax(\n  args:\n    {inputs: ArgMaxInputs, backend: MathBackendWebGL, attrs: ArgMaxAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {axis} = attrs;\n    let axes =
util.parseAxisParam(axis, x.shape);\n    const permutedAxes = backend_util.getAxesPermutation(axes,
x.shape.length);\n    let $x = x;\n    const intermediateTensorInfos = [];\n    if (permutedAxes != null) {\n      $x =
transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n      intermediateTensorInfos.push($x);\n      axes =
backend_util.getInnerMostAxes(axes.length, $x.shape.length);\n    }\n\n    backend_util.assertAxesAreInnerMostDims('argMax', [axes[0]], $x.shape.length);\n    const out =
argMinMaxReduce(backend, $x, axes[0], 'max');\n\n    intermediateTensorInfos.forEach(\n      t =>
backend.disposeIntermediateTensorInfo(t);\n    return out;\n  }\n\nexport const argMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName: 'webgl',\n  kernelFunc: argMax as {} as KernelFunc\n};\n  ,"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {ArgMin, ArgMinAttrs, ArgMinInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{argMinMaxReduce} from '../kernel_utils/arg_min_max';\n\nimport {transpose} from './Transpose';\n\nexport
function argMin(\n  args:\n    {inputs: ArgMinInputs, backend: MathBackendWebGL, attrs: ArgMinAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {axis} = attrs;\n    let axes =
util.parseAxisParam(axis, x.shape);\n    const permutedAxes = backend_util.getAxesPermutation(axes,
x.shape.length);\n    let $x = x;\n    const intermediateTensorInfos = [];\n    if (permutedAxes != null) {\n      $x =
transpose({inputs: {x}, backend, attrs: {perm: permutedAxes}});\n      intermediateTensorInfos.push($x);\n      axes =
backend_util.getInnerMostAxes(axes.length, $x.shape.length);\n    }\n\n

```



```

core';\n\nimport {binaryKernelFunc, CHECK_NAN_SNIPPET_BINARY,
CHECK_NAN_SNIPPET_BINARY_PACKED} from './kernel_utils/kernel_funcs_utils';\n\nconst ATAN2 =
CHECK_NAN_SNIPPET_BINARY + \n return atan(a, b);\n\nconst ATAN2_PACKED = \n vec4 result =
atan(a, b);\n vec4 isNaN = min(vec4(isnan(a)) + vec4(isnan(b)), vec4(1.0));\n ` +\n
CHECK_NAN_SNIPPET_BINARY_PACKED + \n return result;\n\n\nexport const atan2 =\n
binaryKernelFunc({opSnippet: ATAN2, packedOpSnippet: ATAN2_PACKED});\n\nexport const atan2Config:
KernelConfig = {\n kernelName: Atan2,\n backendName: 'webgl',\n kernelFunc: atan2,\n};\n"/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Atanh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from './unaryop_gpu';\n\nconst ATANH =
CHECK_NAN_SNIPPET + \n if ((x < -1.0) || (x > 1.0)) return NAN;\n\nreturn (log(1.0 + x) - log(1.0 - x)) /
2.0;\n\n\nexport const atanh = unaryKernelFunc({opSnippet: ATANH});\n\nexport const atanhConfig: KernelConfig
= {\n kernelName: Atanh,\n backendName: 'webgl',\n kernelFunc: atanh,\n};\n"/**\n * @license\n
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Pool2DProgram implements GPGPUProgram {\n variableNames = ['x'];\n
outputShape: number[];\n userCode: string;\n\n constructor(\n convInfo: backend_util.Conv2DInfo, poolType:
'max'|'avg',\n computePositions: boolean, flattenPositions = false,\n includeBatchInIndex = false) {\n if
(poolType === 'avg' && computePositions) {\n throw new Error('Cannot compute positions for average
pool.);\n }\n\n const filterWidth = convInfo.filterWidth;\n const strideHeight = convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n
const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n const padTop = convInfo.padInfo.top;\n const
padLeft = convInfo.padInfo.left;\n this.outputShape = convInfo.outShape;\n\n const isAvgPool = poolType ===
'avg';\n\n const batchFlattenPositionStr = `((batch * ${convInfo.inHeight} + xR) * ${convInfo.inWidth} + xC) *
${convInfo.inChannels} + d`;\n const flattenPositionStr = \n `(xR * ${convInfo.inWidth} + xC) *
${convInfo.inChannels} + d`;\n\n let initializationValue = '0.0';\n if (!isAvgPool) {\n // WebGL on Firefox
Linux can't compile 1/0 so we do 1/eps.\n initializationValue = '-1.0 / 1e-20';\n }\n\n if (computePositions)
{\n const compareOp = '>=';\n\n this.userCode = \n const ivec2 strides = ivec2(${strideHeight},
${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void main() {\n ivec4
coords = getOutputCoords();\n int batch = coords[0];\n int d = coords[3];\n\n ivec2 xRCCorner =
coords.yz * strides - pads;\n int xRCorner = xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n //
max/min x(?, ?, d) to get y(yR, yC, d).\n // ? = to be determined\n float minMaxValue = 0.0;\n float
minMaxValueFound = 0.0;\n int minMaxPosition = 0;\n float avgValue = 0.0;\n for (int wR = 0;\n
wR < ${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n int xR = xRCorner + wR;\n\n
if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int wC = 0; wC <

```



```

1e-20';\n } \n\n if (computePositions) {\n     const compareOp = '>=';\n\n     this.userCode = `\n     const ivec3
strides =\n     ivec3({strideDepth}, ${strideHeight}, ${strideWidth});\n     const ivec3 pads =
ivec3(${padFront}, ${padTop}, ${padLeft});\n\n     void main() {\n     ivec5 coords = getOutputCoords();\n     int batch = coords.x;\n     int ch = coords.u;\n\n     ivec3 xCorner = ivec3(coords.y, coords.z, coords.w) *
strides - pads;\n     int xDCorner = xCorner.x;\n     int xRCorner = xCorner.y;\n     int xCCorner =
xCorner.z;\n\n     // max/min x(?, ?, ?, ch) to get y(yD, yR, yC, ch).\n     // ? = to be determined\n     float
minMaxValue = 0.0;\n     float minMaxValueFound = 0.0;\n     int minMaxPosition = 0;\n\n     for (int wD
= 0; wD < ${effectiveFilterDepth};\n         wD += ${dilationDepth}) {\n         int xD = xDCorner + wD;\n\n         if (xD < 0 || xD >= ${convInfo.inDepth}) {\n             continue;\n         }\n\n         for (int wR = 0; wR <
${effectiveFilterHeight};\n             wR += ${dilationHeight}) {\n             int xR = xRCorner + wR;\n\n             if
(xR < 0 || xR >= ${convInfo.inHeight}) {\n                 continue;\n             }\n\n             for (int wC = 0; wC <
${effectiveFilterWidth};\n                 wC += ${dilationWidth}) {\n                 int xC = xCCorner + wC;\n\n                 if (xC < 0 || xC >= ${convInfo.inWidth}) {\n                     continue;\n                 }\n\n                 float value =
getX(batch, xD, xR, xC, ch);\n\n                 // If a min / max value has already been found, use it. If not,\n                 //
use the current value.\n                 float currMinMaxValue = mix(\n                     value, minMaxValue,
minMaxValueFound);\n                 if (value ${compareOp} currMinMaxValue) {\n                     minMaxValue =
value;\n                     minMaxValueFound = 1.0;\n                     minMaxPosition = ${\n                         flattenPositions ?\n
(includeBatchInIndex ?\n                             `((batch * ${convInfo.inDepth} + xD) * ${\n
convInfo.inHeight} + xR) * ${convInfo.inWidth} + xC) * ${\n
convInfo.inChannels} + ch`\n
                             : `wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n
wR *
${effectiveFilterWidth} + wC`);\n                     }\n                 }\n                 }\n                 }\n
}\n\n                 setOutput(float(minMaxPosition));\n                 }\n                 `;\n                 return;\n                 }\n\n                 const compareOp = 'max';\n                 let
returnValue = `${poolType}(${poolType})(${poolType}(`\n                 'minMaxValue[0], minMaxValue[1],
minMaxValue[2]), minMaxValue[3]');\n                 if (poolType === 'avg') {\n                     returnValue = `avgValue / count`;\n
}\n\n                 const filterWidthNearestVec4 = Math.floor(filterWidth / 4) * 4;\n                 const filterWidthVec4Remainder =
filterWidth % 4;\n\n                 const updateSnippet = `\n                 if (${isAvgPool}) {\n                     avgValue += dot(values, ones);\n
}\n                 else {\n                     minMaxValue = ${compareOp}(values, minMaxValue);\n                 }\n                 `;\n\n                 this.userCode = `\n
const ivec3 strides =\n                 ivec3(${strideDepth}, ${strideHeight}, ${strideWidth});\n                 const ivec3 pads =
ivec3(${padFront}, ${padTop}, ${padLeft});\n                 const float initializationValue = ${initializationValue};\n
const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n                 float count = 0.0;\n\n                 float getValue(int batch, int xD, int xR, int
xC, int ch) {\n                 if (xC < 0 || xC >= ${convInfo.inWidth}) {\n                     return initializationValue;\n                 }\n
count += 1.0;\n                 return getX(batch, xD, xR, xC, ch);\n                 }\n\n                 void main() {\n                 ivec5 coords =
getOutputCoords();\n                 int batch = coords.x;\n                 int ch = coords.u;\n\n                 ivec3 xCorner = ivec3(coords.y,
coords.z, coords.w) * strides - pads;\n                 int xDCorner = xCorner.x;\n                 int xRCorner = xCorner.y;\n                 int
xCCorner = xCorner.z;\n\n                 // max/min x(?, ?, ?, d) to get y(yD, yR, yC, ch).\n                 // ? = to be determined\n                 vec4 minMaxValue = vec4(${initializationValue});\n                 float avgValue = 0.0;\n                 count = 0.0;\n\n                 for (int
wD = 0; wD < ${effectiveFilterDepth};\n                     wD += ${dilationDepth}) {\n                     int xD = xDCorner + wD;\n\n                     if (xD < 0 || xD >= ${convInfo.inDepth}) {\n                         continue;\n                     }\n\n                     for (int wR = 0; wR <
${effectiveFilterHeight};\n                         wR += ${dilationHeight}) {\n                         int xR = xRCorner + wR;\n\n                         if (xR
< 0 || xR >= ${convInfo.inHeight}) {\n                             continue;\n                         }\n\n                         for (int wC = 0; wC <
${filterWidthNearestVec4}; wC += 4) {\n                             int xC = xCCorner + wC * ${dilationWidth};\n\n                             vec4
values = vec4(\n                                 getValue(batch, xD, xR, xC, ch),\n                                 getValue(batch, xD, xR, xC +
${dilationWidth}, ch),\n                                 getValue(batch, xD, xR, xC + 2 * ${dilationWidth}, ch),\n                                 getValue(batch, xD, xR, xC + 3 * ${dilationWidth}, ch)\n                                 );\n\n                                 ${updateSnippet}\n                             }\n\n                             int xC = xCCorner + ${filterWidthNearestVec4};\n                             if (${filterWidthVec4Remainder} === 1) {\n
vec4 values = vec4(\n                                 getValue(batch, xD, xR, xC, ch),\n                                 initializationValue,\n                                 initializationValue,\n                                 initializationValue\n                                 );\n\n                                 ${updateSnippet}\n                             } else if

```


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```
=====\n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class AvgPool2DBackpropProgram implements GPGPUProgram {\n  variableNames =
['dy'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv2DInfo) {\n    this.outputShape = convInfo.inShape;\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n    const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n    const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n    const avgMultiplier = 1 / (filterHeight * filterWidth);\n\n    this.userCode = `\n    const ivec2 pads = ivec2(${padTop}, ${padLeft});\n    const float avgMultiplier = float(${avgMultiplier});\n\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int b = coords[0];\n      int d = coords[3];\n      ivec2 dyRCCorner = coords.yz - pads;\n      int dyRCorner = dyRCCorner.x;\n      int dyCCorner = dyRCCorner.y;\n      // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n      // ? = to be determined. := across all values in that axis.\n      float dotProd = 0.0;\n      for (int wR = 0; wR < ${effectiveFilterHeight}; wR += ${dilationHeight}) {\n        float dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n        if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n          continue;\n        }\n        int idyR = int(dyR);\n        for (int wC = 0; wC < ${effectiveFilterWidth}; wC += ${dilationWidth}) {\n          float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n          if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 || fract(dyC) > 0.0) {\n            continue;\n          }\n          int idyC = int(dyC);\n          float dyValue = getDy(b, idyR, idyC, d);\n          dotProd += dyValue * avgMultiplier;\n        }\n      }\n      setOutput(dotProd);\n    }\n  }\n\n  export class AvgPool3DBackpropProgram implements GPGPUProgram {\n    variableNames = ['dy'];\n    outputShape: number[];\n    userCode: string;\n\n    constructor(convInfo: backend_util.Conv3DInfo) {\n      this.outputShape = convInfo.inShape;\n      const filterDepth = convInfo.filterDepth;\n      const filterHeight = convInfo.filterHeight;\n      const filterWidth = convInfo.filterWidth;\n      const strideDepth = convInfo.strideDepth;\n      const strideHeight = convInfo.strideHeight;\n      const strideWidth = convInfo.strideWidth;\n      const dilationDepth = convInfo.dilationDepth;\n      const dilationHeight = convInfo.dilationHeight;\n      const dilationWidth = convInfo.dilationWidth;\n      const effectiveFilterDepth = convInfo.effectiveFilterDepth;\n      const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n      const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n      const padFront = effectiveFilterDepth - 1 - convInfo.padInfo.front;\n      const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n      const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n      const avgMultiplier = 1 / (filterDepth * filterHeight * filterWidth);\n\n      this.userCode = `\n      const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n      const float avgMultiplier = float(${avgMultiplier});\n\n      void main() {\n        ivec5 coords = getOutputCoords();\n        int batch = coords.x;\n        int ch = coords.u;\n        ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;\n        int dyDCorner = dyCorner.x;\n        int dyRCorner = dyCorner.y;\n        int dyCCorner = dyCorner.z;\n        // Convolve dy(?, ?, ?, d) with pos mask(:, :, :, ch) to get\n        // dx(xD, xR, xC, ch).\n        // ? = to be determined. := across all values in that axis.\n        float dotProd = 0.0;\n        for (int wD = 0; wD < ${effectiveFilterDepth}; wD += ${dilationDepth}) {\n          float dyD = float(dyDCorner + wD) / ${strideDepth}.0;\n          if (dyD < 0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD) > 0.0) {\n            continue;\n          }\n          int idyD = int(dyD);\n          for (int wR = 0; wR < ${effectiveFilterHeight}; wR += ${dilationHeight}) {\n            float dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n            if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n              continue;\n            }\n            int idyR = int(dyR);\n            for (int wC = 0; wC <
```



```

=====
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {batchMatMulImpl}
from './BatchMatMul_impl';\n\nexport function batchMatMul(args: {\n  inputs: BatchMatMulInputs,\n  attrs:
BatchMatMulAttrs,\n  backend: MathBackendWebGL\n}) {\n  const {inputs, backend, attrs} = args;\n  const {a, b}
= inputs;\n  const {transposeA, transposeB} = attrs;\n\n  return batchMatMulImpl({a, b, transposeA, transposeB,
backend});\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName: BatchMatMul,\n  backendName: 'webgl',\n  kernelFunc: batchMatMul as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class BatchNormProgram implements GPGPUProgram {\n  variableNames: string[];\n  outputShape: number[] = [];\n  userCode: string;\n\n  constructor(\n    xShape: number[], meanShape: number[],\n    varianceShape: number[],\n    offsetShape: number[]|null, scaleShape: number[]|null,\n    varianceEpsilon: number) {\n    this.variableNames = ['x', 'mean', 'variance'];\n    backend_util.assertAndGetBroadcastShape(xShape,
meanShape);\n    backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n    let offsetSnippet =
'0.0';\n    if (offsetShape != null) {\n      backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n      this.variableNames.push('offset');\n      offsetSnippet = 'getOffsetAtOutCoords()';\n    }\n\n    let scaleSnippet =
'1.0';\n    if (scaleShape != null) {\n      backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n      this.variableNames.push('scale');\n      scaleSnippet = 'getScaleAtOutCoords()';\n    }\n\n    this.outputShape =
xShape;\n    this.userCode = `\n    void main() {\n      float x = getXAtOutCoords();\n      float mean =
getMeanAtOutCoords();\n      float variance = getVarianceAtOutCoords();\n      float offset = ${offsetSnippet};\n      float scale = ${scaleSnippet};\n      float inv = scale * inversesqrt(variance + float(${varianceEpsilon}));\n      setOutput(dot(vec3(x, -mean, offset), vec3(inv, inv, 1)));\n    }\n  `;\n}\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class BatchNormPackedProgram implements GPGPUProgram {\n  variableNames:
string[];\n  outputShape: number[];\n  userCode: string;\n  packedInputs = true;\n  packedOutput = true;\n\n  constructor(\n    xShape: number[], meanShape: number[], varianceShape: number[],\n    offsetShape: number[]|null, scaleShape: number[]|null,\n    varianceEpsilon: number) {\n    this.variableNames = ['x', 'mean',
'variance'];\n    backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n    backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n    let offsetSnippet = 'vec4(0.0)';\n    if
(offsetShape != null) {\n      backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n      this.variableNames.push('offset');\n      offsetSnippet = 'getOffsetAtOutCoords()';\n    }\n\n    let scaleSnippet =
'vec4(1.0)';\n    if (scaleShape != null) {\n      backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n      this.variableNames.push('scale');\n      scaleSnippet = 'getScaleAtOutCoords()';\n    }\n\n    this.outputShape =
xShape;\n    this.userCode = `\n    void main() {\n      vec4 offset = ${offsetSnippet};\n      vec4 scale =

```



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${scaleSnippet};\n\n    vec4 x = getXAtOutCoords();\n    vec4 mean = getMeanAtOutCoords();\n    vec4\n    variance = getVarianceAtOutCoords();\n    vec4 inv = scale * inversesqrt(variance +\n    vec4(${varianceEpsilon}));\n    setOutput((x - mean) * inv + offset);\n    }\n    `;\n    }\n}\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {env, FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,\nTensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {BatchNormProgram} from '../batchnorm_gpu';\n\nimport {BatchNormPackedProgram} from\n '../batchnorm_packed_gpu';\n\n\nexport const batchNorm: (params: {\n  inputs: FusedBatchNormInputs,\n  backend:\n  MathBackendWebGL,\n  attrs: FusedBatchNormAttrs\n}) => TensorInfo = ({inputs, backend, attrs}) => {\n  const\n  {x, mean, variance, offset, scale} = inputs;\n\n  util.assert(\n    mean.shape.length === variance.shape.length,\n    () => 'Batch normalization gradient requires mean and variance to have '\n    +\n    'equal ranks.);\n  util.assert(\n    offset == null || mean.shape.length === offset.shape.length,\n    () => 'Batch normalization gradient requires mean\n    and offset to have '\n    +\n    'equal ranks.);\n  util.assert(\n    scale == null || mean.shape.length ===\n    scale.shape.length,\n    () => 'Batch normalization gradient requires mean and scale to have '\n    +\n    'equal\n    ranks.);\n\n  let {varianceEpsilon} = attrs;\n  if (varianceEpsilon == null) {\n    varianceEpsilon = 0.001;\n  }\n\n  const finalInputs = [x, mean, variance];\n  let offsetShape = null;\n  if (offset != null) {\n    offsetShape =\n    offset.shape;\n    finalInputs.push(offset);\n  }\n\n  let scaleShape = null;\n  if (scale != null) {\n    scaleShape =\n    scale.shape;\n    finalInputs.push(scale);\n  }\n\n  const program =\n  env().getBool('WEBGL_PACK_NORMALIZATION') ?\n    new BatchNormPackedProgram(\n      x.shape,\n      mean.shape, variance.shape, offsetShape, scaleShape,\n      varianceEpsilon) :\n    new BatchNormProgram(\n      x.shape, mean.shape, variance.shape, offsetShape, scaleShape,\n      varianceEpsilon);\n  const output =\n  backend.runWebGLProgram(program, finalInputs, finalInputs[0].dtype);\n\n  return output;\n};\n\n\nexport const\n  batchNormConfig: KernelConfig = {\n  kernelName: FusedBatchNorm,\n  backendName: 'webgl',\n  kernelFunc:\n  batchNorm as {\n  } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nimport {getCoordsDataType} from './shader_compiler';\n\n\nexport class SliceProgram implements GPGPUProgram {\n  variableNames = ['source'];\n  outputShape: number[];\n  userCode: string;\n  rank: number;\n\n  // Caching uniform\n  location for speed.\n  startLoc: WebGLUniformLocation;\n\n  constructor(destSize: number[]) {\n    this.outputShape = destSize;\n    this.rank = destSize.length;\n\n    const dtype = getCoordsDataType(this.rank);\n    const uniformPart = `uniform int start[${this.rank}];`;\n    const sourceCoords = getCoords(this.rank);\n\n    let\n    body: string;\n    const coordSum = destSize.map((_, i) => {\n      return `sourceLoc.${coords[i]} = start[${i}] +\n      coords.${coords[i]};`;\n    });\n    body =`\n    ${dtype} sourceLoc;\n    ${dtype} coords =\n    getOutputCoords();\n    ${coordSum.join("\\n")}`;\n\n    this.userCode =`\n    ${uniformPart}\n    void\n    main() {\n    ${body}\n    setOutput(getSource(${sourceCoords}));\n    }\n    `;\n  }\n\n  getCustomSetupFunc(start: number[]) {\n    if (start.length !== this.rank) {\n      throw Error(`The rank

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    (${this.rank}) of the program must match the `+` length of start (${start.length}));\n } \n return (gpgpu:
GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.startLoc == null) {\n this.startLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');\n if (this.startLoc == null) {\n // This means
the compiler has optimized and realized it doesn't need\n // the uniform.\n return;\n }\n }\n
gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\nconst coords = ['x', 'y', 'z', 'w', 'u', 'v'];\nfunction
getCoords(rank: number): string {\n if (rank === 1) {\n return 'sourceLoc';\n } else if (rank <= 6) {\n return
coords.slice(0, rank).map(x => 'sourceLoc.' + x).join(',');\n } else {\n throw Error(`Slicing for rank ${rank} is not
yet supported`);\n }\n }\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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===== \n
*/\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{getChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class
SlicePackedProgram implements GPGPUProgram {\n variableNames = ['source'];\n packedInputs = true;\n
packedOutput = true;\n outputShape: number[];\n userCode: string;\n rank: number;\n\n // Caching uniform
location for speed.\n startLoc: WebGLUniformLocation;\n\n constructor(destSize: number[]) {\n
this.outputShape = destSize;\n this.rank = destSize.length;\n\n const dtype = getCoordsDataType(this.rank);\n
const coords = getChannels('coords', this.rank);\n const sourceLoc = getChannels('sourceLoc', this.rank);\n\n
const innerDims =\n this.rank === 1 ? 'sourceLoc' : `vec2(${sourceLoc.slice(-2).join()})`; \n const getChannel
=\n `getChannel(getSource(${sourceLoc.join()}), ${innerDims})`; \n const upperRow = \n result.x =
${getChannel}; \n if (++${coords[this.rank - 1]} < ${destSize[this.rank - 1]}) {\n ++${sourceLoc[this.rank -
1]}; \n result.y = ${getChannel}; \n --${sourceLoc[this.rank - 1]}; \n } \n `; \n const lowerRow =
this.rank === 1 ? " : \n --${coords[this.rank - 1]}; \n if (++${coords[this.rank - 2]} < ${destSize[this.rank -
2]}) {\n ++${sourceLoc[this.rank - 2]}; \n result.z = ${getChannel}; \n if (++${coords[this.rank - 1]} <
${destSize[this.rank - 1]}) {\n ++${sourceLoc[this.rank - 1]}; \n result.w = ${getChannel}; \n } \n
} \n `; \n\n const sourceLocSetup = this.rank <= 4 ? \n `sourceLoc = coords +\n
${dtype}(${destSize.map((_, i) => `start[${i}]`).join()})`; : \n destSize.map((_, i) => `${sourceLoc[i]} =
${coords[i]} + start[${i}];`)\n .join("\\n"); \n this.userCode = \n uniform int start[${this.rank}]; \n void
main() {\n ${dtype} coords = getOutputCoords(); \n ${dtype} sourceLoc; \n ${sourceLocSetup}\n
vec4 result = vec4(0.); \n ${upperRow}\n ${lowerRow}\n setOutput(result);\n } \n `; \n }\n\n
getCustomSetupFunc(start: number[]) {\n if (start.length !== this.rank) {\n throw Error(\n `The rank
(${this.rank}) of the program must match the `+` length of start (${start.length}));\n } \n return (gpgpu:
GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.startLoc == null) {\n this.startLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');\n if (this.startLoc == null) {\n // This means
the compiler has optimized and realized it doesn't need\n // the uniform.\n return;\n }\n }\n
gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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===== \n
*/\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,

```

```

KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from
'./Transpose';\n\nexport const batchToSpaceND = (args: {\n  inputs: BatchToSpaceNDInputs,\n  backend:
MathBackendWebGL,\n  attrs: BatchToSpaceNDAttrs\n}): TensorInfo => {\n  const {inputs, backend, attrs} =
args;\n  const {x} = inputs;\n  const {blockShape, crops} = attrs;\n\n  util.assert(\n    x.shape.length <= 4,\n    ()
=> 'batchToSpaceND for rank > 4 with a WebGL backend not ' +\n      'implemented yet');\n  const prod =
blockShape.reduce((a, b) => a * b);\n\n  const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n
const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n  const reshapedPermuted =\nbackend_util.getReshapedPermuted(x.shape, blockShape, prod);\n  const sliceBeginCoords =\nbackend_util.getSliceBeginCoords(crops, blockShape.length);\n  const sliceSize =\nbackend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n  const toDispose = [];\n\n  const
reshapedIntermediate =\n  reshape({inputs: {x}, backend, attrs: {shape: reshaped}});\n  const
transposedIntermediate = transpose(\n    {inputs: {x: reshapedIntermediate}, backend, attrs: {perm: permuted}});\n
const reshapedIntermediate2 = reshape({\n  inputs: {x: transposedIntermediate},\n  backend,\n  attrs: {shape:
reshapedPermuted}\n  });\n  const sliced = slice({\n  inputs: {x: reshapedIntermediate2},\n  backend,\n  attrs:
{begin: sliceBeginCoords, size: sliceSize}\n  });\n  toDispose.push(reshapedIntermediate);\n
toDispose.push(transposedIntermediate);\n  toDispose.push(reshapedIntermediate2);\n\n  toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n  return sliced;\n};\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n  kernelName: BatchToSpaceND,\n  backendName: 'webgl',\n  kernelFunc: batchToSpaceND as
{ } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {Bincount, BincountAttrs, BincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {bincountImplCPU}
from './kernel_utils/shared';\n\nexport function bincount(args: {\n  inputs: BincountInputs,\n  backend:
MathBackendWebGL,\n  attrs: BincountAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x,
weights} = inputs;\n  const {size} = attrs;\n\n  const xVals = backend.readSync(x.dataId) as TypedArray;\n  const
weightsVals = backend.readSync(weights.dataId) as TypedArray;\n\n  const outVals =\n  bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape, size);\n\n  return
backend.makeTensorInfo([size], weights.dtype, outVals);\n}\n\nexport const bincountConfig: KernelConfig = {\n
kernelName: Bincount,\n  backendName: 'webgl',\n  kernelFunc: bincount as { } as KernelFunc\n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {UnaryOpProgram} from './unaryop_gpu';\n\nconst TO_INT = `return
float(int(x));`\n\nexport function int(input: TensorInfo, backend: MathBackendWebGL): TensorInfo {\n  const
program = new UnaryOpProgram(input.shape, TO_INT);\n  const output = backend.runWebGLProgram(program,
[input], 'int32');\n  return {dataId: output.dataId, shape: output.shape, dtype: output.dtype};\n}\n\n"/**\n *

```

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```
=====\n*\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ClipProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  userCode: string;\n  outputShape: number[];\n\n  // Caching uniform locations for speed.\n  minLoc: WebGLUniformLocation;\n  maxLoc: WebGLUniformLocation;\n\n  constructor(aShape: number[]) {\n    this.outputShape = aShape;\n    this.userCode =`\n    uniform float minVal;\n    uniform float maxVal;\n    void main() {\n      float value =\n      getAAAtOutCoords();\n      if (isnan(value)) {\n        setOutput(value);\n        return;\n      }\n      setOutput(clamp(value, minVal, maxVal));\n    }\n  }\n\n  getCustomSetupFunc(min: number, max: number) {\n    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n      if (this.minLoc == null) {\n        this.minLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');\n        this.maxLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');\n      }\n      gpgpu.gl.uniform1f(this.minLoc, min);\n      gpgpu.gl.uniform1f(this.maxLoc, max);\n    };}\n\n  }, \"/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n*\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ClipPackedProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  packedInputs = true;\n  packedOutput = true;\n  userCode: string;\n  outputShape: number[];\n\n  // Caching uniform locations for speed.\n  minLoc: WebGLUniformLocation;\n  maxLoc: WebGLUniformLocation;\n\n  constructor(aShape: number[]) {\n    this.outputShape = aShape;\n    this.userCode =`\n    uniform float minVal;\n    uniform float maxVal;\n    void main() {\n      vec4 value = getAAAtOutCoords();\n      if (any(isnan(value))) {\n        setOutput(value);\n        return;\n      }\n      setOutput(clamp(value, vec4(minVal), vec4(maxVal)));\n    }\n  }\n\n  getCustomSetupFunc(min: number, max: number) {\n    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n      if (this.minLoc == null) {\n        this.minLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');\n        this.maxLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');\n      }\n      gpgpu.gl.uniform1f(this.minLoc, min);\n      gpgpu.gl.uniform1f(this.maxLoc, max);\n    };}\n\n  }, \"/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, env, KernelConfig, KernelFunc, TensorInfo}\nfrom '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ClipProgram} from '../clip_gpu';\nimport {ClipPackedProgram} from '../clip_packed_gpu';\n\nexport function clipByValue(args: {\n  inputs: ClipByValueInputs,\n  backend: MathBackendWebGL,\n  attrs: ClipByValueAttrs\n}): TensorInfo {\n
```

```

const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n\n let
program;\n if (env().getBool('WEBGL_PACK_CLIP')) {\n program = new ClipPackedProgram(x.shape);\n }
else {\n program = new ClipProgram(x.shape);\n }\n const customSetup =
program.getCustomSetupFunc(clipValueMin, clipValueMax);\n return backend.runWebGLProgram(program, [x],
x.dtype, customSetup);\n}\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'webgl',\n kernelFunc: clipByValue as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ComplexAbsProgram implements
GPGPUProgram {\n variableNames = ['real', 'imag'];\n userCode: string;\n outputShape: number[];\n\n
constructor(shape: number[]) {\n this.outputShape = shape;\n this.userCode = `\n void main() {\n float re
= abs(getRealAtOutCoords());\n float im = abs(getImagAtOutCoords());\n float mx = max(re, im);\n\n
// sadly the length function in glsl is not underflow-safe\n // (at least not on Intel GPUs). So the safe solution
is\n // to ensure underflow-safety in all cases.\n setOutput(\n mx == 0.0 ? 0.0 : mx * length(vec2(1,
min(re, im)/mx))\n );\n }\n `;\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {ComplexAbs, ComplexAbsInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ComplexAbsProgram} from
'./complex_abs_gpu';\n\n// Returns a TensorInfo with the complex shape and the dataId of the\n// underlying part.
We need to do this because a reshaped complex tensor is\n// not reflected in its parts.\nfunction
makeComplexComponentTensorInfo(\n complexTensor: TensorInfo, complexPart: TensorInfo): TensorInfo {\n
return {\n dataId: complexPart.dataId,\n dtype: complexPart.dtype,\n shape: complexTensor.shape\n
};\n}\n\nexport function complexAbs(\n args: {inputs: ComplexAbsInputs, backend: MathBackendWebGL}):
TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n const xData =
backend.texData.get(x.dataId);\n\n const program = new ComplexAbsProgram(x.shape);\n const programInputs =
[\n makeComplexComponentTensorInfo(x, xData.complexTensorInfos.real),\n
makeComplexComponentTensorInfo(x, xData.complexTensorInfos.imag),\n ];\n\n return
backend.runWebGLProgram(\n program, programInputs, programInputs[0].dtype);\n}\n\nexport const
complexAbsConfig: KernelConfig = {\n kernelName: ComplexAbs,\n backendName: 'webgl',\n kernelFunc:
complexAbs as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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\n

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*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class ConcatProgram implements GPGPUProgram {\n  variableNames: string[];\n  outputShape: number[] = [];\n  userCode: string;\n\n  // Concat 2d tensors along axis=1. See comments in
MathBackendWebGL.concat().\n  constructor(shapes: Array<[number, number]>) {\n    this.outputShape =
backend_util.computeOutShape(shapes, 1 /* axis */);\n    this.variableNames = shapes.map((_, i) => `T${i}`);\n\n    const offsets: number[] = new Array(shapes.length - 1);\n    offsets[0] = shapes[0][1];\n    for (let i = 1; i <
offsets.length; i++) {\n      offsets[i] = offsets[i - 1] + shapes[i][1];\n    }\n\n    const snippets = [\n      `if (yC <
${offsets[0]}) setOutput(getT0(yR, yC));`\n      for (let i = 1; i < offsets.length; i++) {\n        const shift = offsets[i -
1];\n        snippets.push(\n          `else if (yC < ${offsets[i]})` +\n          `setOutput(getT${i}(yR, yC-${shift}));`\n        );\n      }\n      const lastIndex = offsets.length;\n      const lastShift = offsets[offsets.length - 1];\n      snippets.push(`else
setOutput(getT${lastIndex}(yR, yC-${lastShift}));`);\n\n      this.userCode = `\n        void main() {\n          ivec2 coords
= getOutputCoords();\n          int yR = coords.x;\n          int yC = coords.y;\n          ${snippets.join("\n          ")}\n        }\n      `;\n    }\n  }\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the
Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the
License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed
on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the
License.\n   */

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=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class ConcatPackedProgram implements GPGPUProgram {\n  variableNames:
string[];\n  packedInputs = true;\n  packedOutput = true;\n  outputShape: number[] = [];\n  userCode: string;\n\n  constructor(shapes: number[][], axis: number) {\n    this.outputShape = backend_util.computeOutShape(shapes,
axis);\n    const shape = this.outputShape;\n    const rank = shape.length;\n    const dtype =
getCoordsDataType(rank);\n    const coords = getChannels('coords', rank);\n    const channels = ['x', 'y', 'z', 'w', 'u',
'v'].slice(0, rank);\n    this.variableNames = shapes.map((_, i) => `T${i}`);\n\n    const offsets: number[] = new
Array(shapes.length - 1);\n    offsets[0] = shapes[0][axis];\n    for (let i = 1; i < offsets.length; i++) {\n      offsets[i] =
offsets[i - 1] + shapes[i][axis];\n    }\n\n    const channel = channels[axis];\n    const lastChannels = channels.slice(-
2);\n    const allChannels = channels.join();\n\n    let getValueSnippet = `if (${channel} < ${offsets[0]}) {\n
return getChannel(\n      getT0(${allChannels}),\n      vec2(${lastChannels.join()}));\n    }`; \n    for (let i = 1; i <
offsets.length; i++) {\n      const shift = offsets[i - 1];\n      // Note: the >= comparison below may seem unnecessary
given the check\n      // above but is needed to workaround branch execution issues on some\n      // devices. It makes
all the conditions exclusive without relying on\n      // execution order.\n      getValueSnippet += `\n      if
(${channel} < ${offsets[i]} && ${channel} >= ${offsets[i - 1]}) {\n        return getChannel(\n
getT${i}(${shiftedChannels(channels, channel, shift)}),\n          vec2(${shiftedChannels(lastChannels, channel,
shift)}));\n        }`;\n    }\n\n    const lastIndex = offsets.length;\n    const shift = offsets[offsets.length - 1];\n
getValueSnippet += `\n    return getChannel(\n      getT${lastIndex}(${shiftedChannels(channels, channel,
shift)}),\n      vec2(${shiftedChannels(lastChannels, channel, shift)}));`;\n\n    this.userCode = `\n    float
getValue(${channels.map(x => 'int ' + x)}) {\n      ${getValueSnippet}\n    }\n\n    void main() {\n      ${dtype}
coords = getOutputCoords();\n      vec4 result = vec4(getValue(${coords}), 0., 0., 0.); \n      ${coords[rank - 1]}
= ${coords[rank - 1]} + 1;\n      if (${coords[rank - 1]} < ${shape[rank - 1]}) {\n        result.g =
getValue(${coords});\n      }\n      ${coords[rank - 2]} = ${coords[rank - 2]} + 1;\n      if (${coords[rank - 2]}
< ${shape[rank - 2]}) {\n        result.a = getValue(${coords});\n      }\n      ${coords[rank - 1]} =
${coords[rank - 1]} - 1;\n      if (${coords[rank - 2]} < ${shape[rank - 2]} &&\n        ${coords[rank - 1]} <
${shape[rank - 1]}) {\n        result.b = getValue(${coords});\n      }\n      setOutput(result);\n    }\n  `;\n
}\n\n  /**\n   * Return an expression for coordinates into a vector where a given channel\n   * will be offset by

```

```
[shift].\n *\n * @param channels the channels to consider\n * @param channel the channel we want shifted\n * @param shift the amount to subtract from the channel.\n *\n * @returns a string of the form 'x, y-[shift], z' where any one channel can\n * have the shift applied.\n */\nfunction shiftedChannels(channels: string[], channel: string, shift: number) {\n  const channelIdx = channels.indexOf(channel);\n  const res = channels.map((c, idx) => {\n    if (idx === channelIdx) {\n      return `${c} - ${shift}`;\n    } else {\n      return c;\n    }\n  });\n  return res.join();\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {Imag, ImagInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {identity} from './Identity';\n\nexport function imag(args: {inputs: ImagInputs, backend: MathBackendWebGL}):\n  TensorInfo {\n  const {inputs, backend} = args;\n  const {input} = inputs;\n  const inputData = backend.texData.get(input.dataId);\n  \n  return identity({inputs: {x: inputData.complexTensorInfos.imag}, backend});\n}\n\nexport const imagConfig: KernelConfig = {\n  kernelName: Imag,\n  backendName: 'webgl',\n  kernelFunc: imag as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {concatImpl} from './Concat_impl';\nimport {identity} from './Identity';\n\nexport function concat(\n  args: {\n    inputs: ConcatInputs, attrs: ConcatAttrs, backend: MathBackendWebGL\n  }):\n  TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {axis} = attrs;\n  const $axis = util.parseAxisParam(axis, inputs[0].shape)[0];\n  const outShape =\n    backend_util.computeOutShape(inputs.map(t => t.shape), $axis);\n  \n  if (util.sizeFromShape(outShape) === 0) {\n    return backend.makeTensorInfo(outShape, inputs[0].dtype, []);\n  }\n  \n  // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n  if ($inputs.length === 1) {\n    return identity({inputs: {x: $inputs[0]}, backend});\n  }\n  \n  const shapes = $inputs.map(t => t.shape);\n  backend_util.assertParamsConsistent(shapes, $axis);\n  \n  return concatImpl($inputs, $axis, backend);\n}\n\nexport const concatConfig: KernelConfig = {\n  kernelName: Concat,\n  backendName: 'webgl',\n  kernelFunc: concat as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class Conv2DProgram implements GPGPUProgram {\n  variableNames = ['x', 'W'];\n  outputShape: number[];\n  userCode: string;\n  \n  constructor(\n    convInfo: backend_util.Conv2DInfo, addBias =
```

```

false,\n  activation: string = null, hasPreluActivationWeights = false,\n  hasLeakyreluAlpha = false) {\n
this.outputShape = convInfo.outShape;\n  const padTop = convInfo.padInfo.top;\n  const padLeft =
convInfo.padInfo.left;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =
convInfo.filterWidth;\n\n  const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n  const
inputDepthVec4Remainder = convInfo.inChannels % 4;\n  const isChannelsLast = convInfo.dataFormat ===
'channelsLast';\n\n  const rowDim = isChannelsLast ? 1 : 2;\n  const colDim = isChannelsLast ? 2 : 3;\n  const
channelDim = isChannelsLast ? 3 : 1;\n\n  let activationSnippet = ", applyActivationSnippet = ";\n  if (activation)
{\n    if (hasPreluActivationWeights) {\n      activationSnippet = `float activation(float a) {\n        float b =
getPreluActivationWeightsAtOutCoords();\n          ${activation}\n        }`; \n    } else if (hasLeakyreluAlpha) {\n
activationSnippet = `float activation(float a) {\n        float b = getLeakyreluAlphaAtOutCoords();\n
${activation}\n        }`; \n    } else {\n      activationSnippet = `\n        float activation(float x) {\n
${activation}\n        }\n        `;\n    }\n\n    applyActivationSnippet = `result = activation(result);`; \n  }\n\n
const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords();' : ";\n  if (addBias) {\n
this.variableNames.push('bias');\n  }\n\n  if (hasPreluActivationWeights) {\n
this.variableNames.push('preluActivationWeights');\n  }\n\n  if (hasLeakyreluAlpha) {\n
this.variableNames.push('leakyreluAlpha');\n  }\n\n  this.userCode = `\n    ${activationSnippet}\n\n    const
ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n    const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n
void main() {\n      ivec4 coords = getOutputCoords();\n      int batch = coords[0];\n      int d2 =
coords[${channelDim}];\n\n      ivec2 xRCCorner =\n          ivec2(coords[${rowDim}], coords[${colDim}]) *
strides - pads;\n      int xRCorner = xRCCorner.x;\n      int xCCorner = xRCCorner.y;\n\n      // Convolve x(?, ?,
d1) with w(:, :, d1, d2) to get y(yR, yC, d2).\n      // ? = to be determined. := across all values in that axis.\n
float dotProd = 0.0;\n      for (int wR = 0; wR < ${filterHeight}; wR++) {\n          int xR = xRCorner + wR *
${dilationHeight};\n\n          if (xR < 0 || xR >= ${convInfo.inHeight}) {\n              continue;\n          }\n\n
for (int wC = 0; wC < ${filterWidth}; wC++) {\n          int xC = xCCorner + wC * ${dilationWidth};\n\n          if (xC
< 0 || xC >= ${convInfo.inWidth}) {\n              continue;\n          }\n\n          for (int d1 = 0; d1 <
${inputDepthNearestVec4}; d1 += 4) {\n              vec4 wValues = vec4(\n                  getW(wR, wC, d1, d2),\n
getW(wR, wC, d1 + 1, d2),\n                  getW(wR, wC, d1 + 2, d2),\n                  getW(wR, wC, d1 + 3, d2)\n
);\n\n              if (${isChannelsLast}) {\n                  vec4 xValues = vec4(\n                      getX(batch, xR, xC, d1),\n
getX(batch, xR, xC, d1 + 1),\n                      getX(batch, xR, xC, d1 + 2),\n                      getX(batch, xR, xC, d1 +
3)\n                  );\n                  dotProd += dot(xValues, wValues);\n              } else {\n                  vec4 xValues =
vec4(\n                      getX(batch, d1, xR, xC),\n                      getX(batch, d1 + 1, xR, xC),\n                      getX(batch, d1 +
2, xR, xC),\n                      getX(batch, d1 + 3, xR, xC)\n                  );\n                  dotProd += dot(xValues, wValues);\n
              }\n\n              if (${inputDepthVec4Remainder === 1}) {\n                  if (${isChannelsLast}) {\n
dotProd +=\n                      getX(batch, xR, xC, ${inputDepthNearestVec4}) * \n                      getW(wR, wC,
${inputDepthNearestVec4}, d2);\n                  } else {\n                      dotProd +=\n                      getX(batch,
${inputDepthNearestVec4}, xR, xC) * \n                      getW(wR, wC, ${inputDepthNearestVec4}, d2);\n                  }\n
              } else if (${inputDepthVec4Remainder === 2}) {\n                  vec2 wValues = vec2(\n
getW(wR, wC, ${inputDepthNearestVec4}, d2),\n                      getW(wR, wC, ${inputDepthNearestVec4} + 1, d2)\n
);\n\n                  if (${isChannelsLast}) {\n                      vec2 xValues = vec2(\n                          getX(batch, xR, xC,
${inputDepthNearestVec4}),\n                          getX(batch, xR, xC, ${inputDepthNearestVec4} + 1)\n                      );\n
dotProd += dot(xValues, wValues);\n                  } else {\n                      vec2 xValues = vec2(\n                          getX(batch,
${inputDepthNearestVec4}, xR, xC),\n                          getX(batch, ${inputDepthNearestVec4} + 1, xR, xC)\n                      );\n
dotProd += dot(xValues, wValues);\n                  }\n\n              } else if (${inputDepthVec4Remainder ===
3}) {\n                  vec3 wValues = vec3(\n                      getW(wR, wC, ${inputDepthNearestVec4}, d2),\n
getW(wR, wC, ${inputDepthNearestVec4} + 1, d2),\n                      getW(wR, wC, ${inputDepthNearestVec4} + 2,
d2)\n                  );\n\n                  if (${isChannelsLast}) {\n                      vec3 xValues = vec3(\n
getX(batch, xR,

```



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xC, ${inputDepthNearestVec4}),\n          getX(batch, xR, xC, ${inputDepthNearestVec4} + 1),\n          getX(batch, xR, xC, ${inputDepthNearestVec4} + 2)\n          );\n          dotProd += dot(xValues, wValues);\n        } else {\n          vec3 xValues = vec3(\n          getX(batch, ${inputDepthNearestVec4}, xR, xC),\n          getX(batch, ${inputDepthNearestVec4} + 1, xR, xC),\n          getX(batch, ${inputDepthNearestVec4} +\n2, xR, xC)\n          );\n          dotProd += dot(xValues, wValues);\n        }\n      }\n      float result = dotProd;\n      ${addBiasSnippet}\n      ${applyActivationSnippet}\n      setOutput(result);\n    }\n  }\n}\n\nexport class Conv3DProgram implements GPGPUProgram {\n  variableNames = ['x', 'W'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo:\nbackend_util.Conv3DInfo) {\n    this.outputShape = convInfo.outShape;\n    const padFront =\nconvInfo.padInfo.front;\n    const padTop = convInfo.padInfo.top;\n    const padLeft = convInfo.padInfo.left;\n    const strideDepth = convInfo.strideDepth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =\nconvInfo.strideWidth;\n    const dilationDepth = convInfo.dilationDepth;\n    const dilationHeight =\nconvInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const filterDepth =\nconvInfo.filterDepth;\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth =\nconvInfo.filterWidth;\n\n    const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n    const\ninputDepthVec4Remainder = convInfo.inChannels % 4;\n\n    this.userCode = `\n    const ivec3 strides =\nivec3(${strideDepth}, ${strideHeight}, ${\nstrideWidth});\n    const ivec3 pads = ivec3(${padFront},\n${padTop}, ${padLeft});\n\n    void main() {\n      ivec5 coords = getOutputCoords();\n      int batch =\ncoords.x;\n      int d2 = coords.u;\n\n      ivec3 xFRCCorner = ivec3(coords.y, coords.z, coords.w) * strides -\npads;\n      int xFCorner = xFRCCorner.x;\n      int xRCorner = xFRCCorner.y;\n      int xCCorner =\nxFRCCorner.z;\n\n      // Convolve x(?, ?, ?, d1) with w(:, :, :, d1, d2) to get\n      // y(yF, yR, yC, d2). ? = to be\ndetermined. : = across all\n      // values in that axis.\n      float dotProd = 0.0;\n      for (int wF = 0; wF <\n${filterDepth}; wF++) {\n        int xF = xFCorner + wF * ${dilationDepth};\n        if (xF < 0 || xF >=\n${convInfo.inDepth}) {\n          continue;\n        }\n        for (int wR = 0; wR < ${filterHeight}; wR++) {\n          int xR = xRCorner + wR * ${dilationHeight};\n          if (xR < 0 || xR >= ${convInfo.inHeight}) {\n            continue;\n          }\n          for (int wC = 0; wC < ${filterWidth}; wC++) {\n            int xC = xCCorner + wC *\n${dilationWidth};\n            if (xC < 0 || xC >= ${convInfo.inWidth}) {\n              continue;\n            }\n            for (int d1 = 0; d1 < ${inputDepthNearestVec4}; d1 += 4) {\n              vec4 xValues = vec4(\ngetX(batch, xF, xR, xC, d1),\n          getX(batch, xF, xR, xC, d1 + 1),\n          getX(batch, xF, xR, xC, d1 +\n2),\n          getX(batch, xF, xR, xC, d1 + 3)\n          );\n              vec4 wValues = vec4(\ngetW(wF, wR, wC, d1, d2),\n          getW(wF, wR, wC, d1 + 1, d2),\n          getW(wF, wR, wC, d1 + 2,\nd2),\n          getW(wF, wR, wC, d1 + 3, d2)\n          );\n              dotProd += dot(xValues, wValues);\n            }\n            if (${inputDepthVec4Remainder} === 1) {\n              dotProd +=\n          getX(batch, xF,\nxR, xC, ${inputDepthNearestVec4}) *\n          getW(wF, wR, wC, ${inputDepthNearestVec4}, d2);\n            } else if (${inputDepthVec4Remainder} === 2) {\n              vec2 xValues = vec2(\n          getX(batch, xF, xR,\nxC, ${inputDepthNearestVec4}),\n          getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 1)\n          );\n              vec2 wValues = vec2(\n          getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n          getW(wF, wR, wC, ${inputDepthNearestVec4} + 1, d2)\n          );\n              dotProd += dot(xValues,\nwValues);\n            } else if (${inputDepthVec4Remainder} === 3) {\n              vec3 xValues = vec3(\n          getX(batch, xF, xR, xC,\n${inputDepthNearestVec4}),\n          getX(batch, xF, xR, xC,\n${inputDepthNearestVec4} + 1),\n          getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 2)\n          );\n              vec3 wValues = vec3(\n          getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n          getW(wF, wR, wC,\n${inputDepthNearestVec4} + 1, d2),\n          getW(wF, wR, wC,\n${inputDepthNearestVec4} + 2, d2)\n          );\n              dotProd += dot(xValues, wValues);\n            }\n          }\n        }\n      }\n      setOutput(dotProd);\n    }\n  }\n}\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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outerShapeFilter = convInfo.outChannels;\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n
const transposeA = false;\n const transposeB = false;\n\n let out: TensorInfo;\n const intermediates: TensorInfo[] =
[];\n\n // TODO: Once reduction ops are packed, batchMatMul will always be packed\n // and we can remove this
condition.\n const batchMatMulWillBeUnpacked =\n (outerShapeX === 1 || outerShapeFilter === 1) &&\n
sharedMatMulDim > MATMUL_SHARED_DIM_THRESHOLD;\n const reshapeWillBeExpensive = xShape[2]
% 2 !== 0 && !xTexData.isPacked;\n\n if (batchMatMulWillBeUnpacked ||
!env().getBool('WEBGL_LAZILY_UNPACK') ||\n !env().getBool('WEBGL_PACK_BINARY_OPERATIONS')
||\n !reshapeWillBeExpensive) {\n const targetShape = isChannelsLast ? xShape[0] * xShape[1] * xShape[2] :\n
xShape[0] * xShape[2] * xShape[3];\n const xReshaped = reshape({\n inputs: {x},\n
backend,\n attrs: {shape: [1, targetShape, convInfo.inChannels]}\n });\n const filterReshaped = reshape({\n
inputs: {x: filter},\n backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n
const result = batchMatMulImpl({\n a: xReshaped,\n b: filterReshaped,\n transposeA,\n transposeB,\n
backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n\n out =
reshape(\n {inputs: {x: result}}, backend, attrs: {shape: convInfo.outShape});\n\n
intermediates.push(xReshaped);\n intermediates.push(filterReshaped);\n intermediates.push(result);\n } else {\n
// Following optimization is specific to packed |x| with odd row count\n // (For example, in channelLast mode,
'row count' refers to x.shape[2]):\n // we avoid expensive packed 2x2 reshape by padding row count to next,\n //
even number. When x.shape[2] is odd, the result of packed batchMatMul is\n // the same (has the same texture
layout and values in the texture) as\n // it is for even x.shape[2] + 1. We make the odd-rows tensor to look
like\n // even-rows tensor before the operation and, after the batchMatMul,\n // fix the even-rows result to have
odd number of rows.\n const targetShape = isChannelsLast ?\n xShape[0] * xShape[1] * (xShape[2] + 1) :\n
xShape[0] * xShape[2] * (xShape[3] + 1);\n const xReshaped: TensorInfo = {\n dataId: x.dataId,\n shape:
[1, targetShape, convInfo.inChannels],\n dtype: x.dtype\n }; \n // xTexData.shape gets referenced from
GPGPUBinary.inShapeInfos.\n // Decrementing row count, after batchMatMul->...->compileProgram leads to\n
// invalid row count within the reference in GPGPUBinary.inShapeInfos.\n // Alternative fix would be to provide a
copy to GPGPUBinary.inShapeInfos\n // in compileProgram method, but that would affect compilation of all\n //
programs - instead, provide a copy here, with even row count, before\n // calling batchMatMul->...-
>compileProgram and after that, the original\n // xTexData.shape is restored.\n const originalXTexDataShape =
xTexData.shape;\n xTexData.shape = xTexData.shape.slice();\n xTexData.shape[xTexData.shape.length -
2]++; \n util.assert(\n webgl_util.isReshapeFree(xTexData.shape, xReshaped.shape),\n () => `packed
reshape ${xTexData.shape} to ${\n xReshaped.shape} isn't free`);\n const filterReshaped = reshape({\n
inputs: {x: filter},\n backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n
intermediates.push(filterReshaped);\n const pointwiseConv = batchMatMulImpl({\n a: xReshaped,\n b:
filterReshaped,\n backend,\n transposeA,\n transposeB,\n bias,\n activation,\n
preluActivationWeights,\n leakyreluAlpha\n });\n\n const pointwiseConvTexData =
backend.texData.get(pointwiseConv.dataId);\n util.assert(\n pointwiseConvTexData.isPacked,\n () =>
'batchMatMul result is expected to be packed');\n // Restore the input shape to original.\n xTexData.shape =
originalXTexDataShape;\n // Set the output shape - there is no need for expensive reshape as data\n // layout is
already correct.\n pointwiseConvTexData.shape = convInfo.outShape;\n\n out = identity({inputs: {x:
pointwiseConv}, backend});\n out.shape = convInfo.outShape;\n\n intermediates.push(pointwiseConv);\n }\n\n
for (const i of intermediates) {\n backend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n}\n\n//
Implements the im2row algorithm as outlined in \"High Performance\n// Convolutional Neural Networks for
Document Processing\" (Suvisoft, 2006)\nexport function conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n
backend,\n bias = null,\n preluActivationWeights = null,\n leakyreluAlpha = 0,\n activation = null\n}):
Conv2DConfig {\n // Rearranges conv2d input so each block to be convolved over forms the\n // column of a new
matrix with shape [filterWidth * filterHeight *\n // inChannels, outHeight * outWidth]. The filter is also rearranged
so each\n // output channel forms a row of a new matrix with shape [outChannels,\n // filterWidth * filterHeight *
inChannels]. The convolution is then\n // computed by multiplying these matrices and reshaping the result.\n const

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{\n  filterWidth,\n  filterHeight,\n  inChannels,\n  outWidth,\n  outHeight,\n  dataFormat\n } = convInfo;\n\n
const isChannelsLast = dataFormat === 'channelsLast';\n\n const sharedDim = filterWidth * filterHeight *
inChannels;\n\n const numCols = outHeight * outWidth;\n\n const x2ColShape = [sharedDim, numCols];\n\n const
transposeA = true;\n\n const transposeB = false;\n\n\n const intermediates: TensorInfo[] = [];\n\n const xSqueezed =\n
  reshape({inputs: {x}, backend, attrs: {shape: x.shape.slice(1)}});\n\n const w2Row = reshape({\n  inputs: {x:
filter},\n  backend,\n  attrs: {shape: [1, sharedDim, util.sizeFromShape(filter.shape) / sharedDim]}\n });\n\n\n
intermediates.push(xSqueezed);\n\n intermediates.push(w2Row);\n\n\n const im2ColProgram =\n  new
Im2ColPackedProgram(x2ColShape, xSqueezed.shape, convInfo);\n\n const im2Col =
backend.runWebGLProgram(im2ColProgram, [xSqueezed], 'float32');\n\n const im2ColReshaped = reshape({\n
inputs: {x: im2Col},\n  backend,\n  attrs: {shape: [1, x2ColShape[0], x2ColShape[1]]}\n });\n\n\n
intermediates.push(im2Col);\n\n intermediates.push(im2ColReshaped);\n\n\n const hasBias = bias != null;\n\n const
hasPreluActivationWeights = preluActivationWeights != null;\n\n const hasLeakyreluAlpha = activation ===
'leakyrelu';\n\n const fusedActivation =\n  activation ? mapActivationToShaderProgram(activation, true) : null;\n\n\n
const matmulProgram = new MatMulPackedProgram(\n  im2ColReshaped.shape as [number, number, number],\n
  w2Row.shape as [number, number, number],\n  [1, numCols, convInfo.outChannels], transposeA, transposeB,
hasBias,\n  fusedActivation, hasPreluActivationWeights, hasLeakyreluAlpha);\n\n const inputs: TensorInfo[] =
[im2ColReshaped, w2Row];\n\n if (bias) {\n  inputs.push(bias);\n  }\n\n if (hasPreluActivationWeights) {\n
inputs.push(reluActivationWeights);\n  }\n\n if (hasLeakyreluAlpha) {\n  const $leakyreluAlpha =
backend.makeTensorInfo(\n  [], 'float32',\n  util.createScalarValue(leakyreluAlpha as {} as 'float32',
'float32'));\n  inputs.push($leakyreluAlpha);\n  intermediates.push($leakyreluAlpha);\n  }\n\n const product =
backend.runWebGLProgram(matmulProgram, inputs, 'float32');\n\n\n const outShape = isChannelsLast ?\n  [1,
outHeight, outWidth, convInfo.outChannels] :\n  [1, convInfo.outChannels, outHeight, outWidth];\n\n const out
=\n  reshape({inputs: {x: product}, backend, attrs: {shape: outShape}});\n\n\n intermediates.push(product);\n\n for
(const i of intermediates) {\n  backend.disposeIntermediateTensorInfo(i);\n  }\n\n\n return out;\n\n\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n\n *
=====\n\n
*/\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, env, KernelConfig, KernelFunc, TensorInfo}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{Conv2DProgram} from './conv_gpu';\n\nimport {conv2dByMatMul, conv2dWithIm2Row} from
'./Conv2D_impl';\n\nimport {reshape} from './Reshape';\n\nexport function conv2d(\n  args:\n  {inputs:
Conv2DInputs, attrs: Conv2DAttrs, backend: MathBackendWebGL}) {\n  const {inputs, backend, attrs} = args;\n
const {x, filter} = inputs;\n  const {strides, pad, dataFormat, dilations, dimRoundingMode} = attrs;\n\n const
$dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo =
backend_util.computeConv2DInfo(\n  x.shape as [number, number, number, number],\n  filter.shape as
[number, number, number, number], strides, dilations, pad,\n  dimRoundingMode, false /* depthwise */,
$dataFormat);\n\n let out: TensorInfo;\n\n if (convInfo.filterHeight === 1 && convInfo.filterWidth === 1 &&\n
convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\n  convInfo.strideHeight === 1 &&
convInfo.strideWidth === 1 &&\n  (convInfo.padInfo.type === 'SAME' || convInfo.padInfo.type === 'VALID'))
{\n  out = conv2dByMatMul({x, filter, convInfo, backend});\n  }\n  else if
(env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n  out = conv2dWithIm2Row({x, filter,
convInfo, backend});\n  }\n  else {\n  const program = new Conv2DProgram(convInfo);\n  out =
backend.runWebGLProgram(program, [x, filter], 'float32');\n  }\n\n const outReshaped =\n  reshape({inputs: {x:
out}, backend, attrs: {shape: convInfo.outShape}});\n\n\n backend.disposeIntermediateTensorInfo(out);\n\n\n return

```

```

outReshaped;\n}\n\nexport const conv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName:
'webgl',\n  kernelFunc: conv2d as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```

```

=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'/gpgpu_math';\n\nexport class Conv2DDerFilterProgram implements GPGPUProgram {\n  variableNames = ['x',
'dy'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv2DInfo) {\n    this.outputShape = convInfo.filterShape;\n\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =
convInfo.strideWidth;\n    const padTop = convInfo.padInfo.top;\n    const padLeft = convInfo.padInfo.left;\n    const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n    this.userCode = `\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int wR = coords.x;\n      int wC = coords.y;\n      int d1 = coords.z;\n      int d2 = coords.w;\n      // Convolve x(?, ?, d1) with dy(:, :, d2) to get dw(wR, wC, d1, d2).\n      // ? = to be
determined. := across all values in that axis.\n      float dotProd = 0.0;\n      for (int b = 0; b <
${convInfo.batchSize}; b++) {\n        for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n          int xR = wR
+ yR * ${strideHeight} - ${padTop};\n          if (xR < 0 || xR >= ${convInfo.inHeight}) {\n            continue;\n          }\n          for (int yC = 0; yC < ${convInfo.outWidth}; yC++) {\n            int xC = wC + yC *
${strideWidth} - ${padLeft};\n            if (xC < 0 || xC >= ${convInfo.inWidth}) {\n              continue;\n            }\n            if (${isChannelsLast}) {\n              float dyValue = getDy(b, yR, yC, d2);\n              float xValue =
getX(b, xR, xC, d1);\n              dotProd += (xValue * dyValue);\n            } else {\n              float dyValue =
getDy(b, d2, yR, yC);\n              float xValue = getX(b, d1, xR, xC);\n              dotProd += (xValue * dyValue);\n            }\n          }\n        }\n      }\n      setOutput(dotProd);\n    }\n  }\n}\n\nexport class
Conv2DDerInputProgram implements GPGPUProgram {\n  variableNames = ['dy', 'W'];\n  outputShape:
number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv2DInfo) {\n    this.outputShape =
convInfo.inShape;\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const isChannelsLast =
convInfo.dataFormat === 'channelsLast';\n\n    const padTop = filterHeight - 1 - convInfo.padInfo.top;\n    const
padLeft = filterWidth - 1 - convInfo.padInfo.left;\n\n    const rowDim = isChannelsLast ? 1 : 2;\n    const colDim =
isChannelsLast ? 2 : 3;\n    const channelDim = isChannelsLast ? 3 : 1;\n\n    this.userCode = `\n    const ivec2 pads
= ivec2(${padTop}, ${padLeft});\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int batch =
coords[0];\n      int d1 = coords[${channelDim}];\n      ivec2 dyCorner = ivec2(coords[${rowDim}],
coords[${colDim}]) - pads;\n      int dyRCorner = dyCorner.x;\n      int dyCCorner = dyCorner.y;\n      //
Convolve dy(?, ?, d2) with w(:, :, d1, d2) to compute dx(xR, xC, d1).\n      // ? = to be determined. := across all
values in that axis.\n      float dotProd = 0.0;\n      for (int wR = 0; wR < ${filterHeight}; wR++) {\n        float
dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n        if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||
fract(dyR) > 0.0) {\n          continue;\n        }\n        int idyR = int(dyR);\n        int wRPerm = ${filterHeight} -
1 - wR;\n        for (int wC = 0; wC < ${filterWidth}; wC++) {\n          float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n          if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 || fract(dyC) > 0.0) {\n            continue;\n          }\n          int idyC = int(dyC);\n          int wCPerm = ${filterWidth} - 1 - wC;\n          for
(int d2 = 0; d2 < ${convInfo.outChannels}; d2++) {\n            if (${isChannelsLast}) {\n              float xValue =
getDy(batch, idyR, idyC, d2);\n              float wValue = getW(wRPerm, wCPerm, d1, d2);\n              dotProd +=
xValue * wValue;\n            } else {\n              float xValue = getDy(batch, d2, idyR, idyC);\n              float
wValue = getW(wRPerm, wCPerm, d1, d2);\n              dotProd += xValue * wValue;\n            }\n          }\n        }\n      }\n      setOutput(dotProd);\n    }\n  }\n}\n\nexport class Conv3DDerFilterProgram implements

```

```

GPGPUProgram {
  variableNames = ['x', 'dy'];
  outputShape: number[];
  userCode: string;

  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.filterShape;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const padFront = convInfo.padInfo.front;
    const padTop = convInfo.padInfo.top;
    const padLeft = convInfo.padInfo.left;

    this.userCode = `
      void main() {
        ivec5 coords = getOutputCoords();
        int wF = coords.x;
        int wR = coords.y;
        int wC = coords.z;
        int d1 = coords.w;
        int d2 = coords.u;
        float dotProd = 0.0;
        for (int b = 0; b < ${convInfo.batchSize}; b++) {
          for (int yF = 0; yF < ${convInfo.outDepth}; yF++) {
            int xF = wF + yF * ${strideDepth} - ${padFront};
            if (xF < 0 || xF >= ${convInfo.inDepth}) continue;
            for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {
              int xR = wR + yR * ${strideHeight} - ${padTop};
              if (xR < 0 || xR >= ${convInfo.inHeight}) continue;
              for (int yC = 0; yC < ${convInfo.outWidth}; yC++) {
                int xC = wC + yC * ${strideWidth} - ${padLeft};
                if (xC < 0 || xC >= ${convInfo.inWidth}) continue;
                float dyValue = getDy(b, yF, yR, yC, d2);
                float xValue = getX(b, xF, xR, xC, d1);
                dotProd += (xValue * dyValue);
              }
            }
          }
        }
        setOutput(dotProd);
      }
    `;
  }
}

Conv3DDerInputProgram implements GPGPUProgram {
  variableNames = ['dy', 'W'];
  outputShape: number[];
  userCode: string;

  constructor(convInfo: backend_util.Conv3DInfo) {
    this.outputShape = convInfo.inShape;
    const filterDepth = convInfo.filterDepth;
    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const strideDepth = convInfo.strideDepth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const padFront = filterDepth - 1 - convInfo.padInfo.front;
    const padTop = filterHeight - 1 - convInfo.padInfo.top;
    const padLeft = filterWidth - 1 - convInfo.padInfo.left;

    this.userCode = `
      const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});
      void main() {
        ivec5 coords = getOutputCoords();
        int batch = coords.x;
        int d1 = coords.u;
        ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;
        int dyFCorner = dyCorner.x;
        int dyRCorner = dyCorner.y;
        int dyCCorner = dyCorner.z;
        float dotProd = 0.0;
        for (int wF = 0; wF < ${filterDepth}; wF++) {
          float dyF = float(dyFCorner + wF) / ${strideDepth}.0;
          if (dyF < 0.0 || dyF >= ${convInfo.outDepth}.0 || fract(dyF) > 0.0) continue;
          int idyF = int(dyF);
          for (int wR = 0; wR < ${filterHeight}; wR++) {
            float dyR = float(dyRCorner + wR) / ${strideHeight}.0;
            if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) continue;
            int idyR = int(dyR);
            for (int wC = 0; wC < ${filterWidth}; wC++) {
              float dyC = float(dyCCorner + wC) / ${strideWidth}.0;
              if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 || fract(dyC) > 0.0) continue;
              int idyC = int(dyC);
              for (int d2 = 0; d2 < ${convInfo.outChannels}; d2++) {
                float xValue = getDy(batch, idyF, idyR, idyC, d2);
                float wValue = getW(wFPerm, wRPerm, wCPerm, d1, d2);
                dotProd += xValue * wValue;
              }
            }
          }
        }
        setOutput(dotProd);
      }
    `;
  }
}

*
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*
=====
*
*import {backend_util, Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
*import {MathBackendWebGL} from './backend_webgl';
*import {Conv2DDerFilterProgram} from './conv_backprop_gpu';
*export function conv2DBackpropFilter(args: {
  inputs: Conv2DBackpropFilterInputs,
  attrs: Conv2DBackpropFilterAttrs,

```

```

backend: MathBackendWebGL\n)) {\n const {inputs, backend, attrs} = args;\n const {x, dy} = inputs;\n const
{strides, pad, dataFormat, dimRoundingMode, filterShape} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
x.shape as [number, number, number, number], filterShape, strides,\n 1 /* dilations */, pad, dimRoundingMode,
false /* depthwise */, \n $dataFormat);\n\n const program = new Conv2DDerFilterProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, dy], 'float32');\n}\n\nexport const conv2DBackpropFilterConfig:
KernelConfig = {\n kernelName: Conv2DBackpropFilter,\n backendName: 'webgl',\n kernelFunc:
conv2DBackpropFilter as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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===== \n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {Conv2DDerInputProgram} from './conv_backprop_gpu';\n\nexport function
conv2DBackpropInput(args: {\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs,\n
backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const
{inputShape, strides, pad, dataFormat, dimRoundingMode} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n 1 /* dilations */, pad,
dimRoundingMode, false, $dataFormat);\n\n const program = new Conv2DDerInputProgram(convInfo);\n return
backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const conv2DBackpropInputConfig:
KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'webgl',\n kernelFunc:
conv2DBackpropInput as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {backend_util, Conv3D, Conv3DAttrs, Conv3DInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {Conv3DProgram}
from './conv_gpu';\n\nexport function conv3D(\n args:\n {inputs: Conv3DInputs, attrs: Conv3DAttrs,
backend: MathBackendWebGL}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const
{strides, pad, dilations} = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n x.shape as [number,
number, number, number, number], \n filter.shape as [number, number, number, number, number], strides,\n
dilations, pad);\n\n const program = new Conv3DProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, filter], 'float32');\n}\n\nexport const conv3DConfig: KernelConfig = {\n
kernelName: Conv3D,\n backendName: 'webgl',\n kernelFunc: conv3D as {} as KernelFunc,\n};\n"/**\n *
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```

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```
=====\n\n*\n\nimport { backend_util, Conv3DBackpropFilterV2, Conv3DBackpropFilterV2Attrs,  
Conv3DBackpropFilterV2Inputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport  
{ MathBackendWebGL } from './backend_webgl';\n\nimport { Conv3DDerFilterProgram } from  
 './conv_backprop_gpu';\n\nexport function conv3DBackpropFilterV2(args: {\n inputs:  
Conv3DBackpropFilterV2Inputs,\n attrs: Conv3DBackpropFilterV2Attrs,\n backend: MathBackendWebGL\n})  
{\n const { inputs, backend, attrs } = args;\n const { x, dy } = inputs;\n const { strides, pad, filterShape } = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n x.shape as [number, number, number, number, number],  
filterShape, strides,\n 1 /* dilations */, pad);\n\n const program = new Conv3DDerFilterProgram(convInfo);\n\n return backend.runWebGLProgram(program, [x, dy], 'float32');\n}\n\nexport const  
conv3DBackpropFilterV2Config: KernelConfig = {\n kernelName: Conv3DBackpropFilterV2,\n backendName:  
'webgl',\n kernelFunc: conv3DBackpropFilterV2 as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
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```

```
=====\n\n*\n\nimport { backend_util, Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,  
Conv3DBackpropInputV2Inputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport  
{ MathBackendWebGL } from './backend_webgl';\n\nimport { Conv3DDerInputProgram } from  
 './conv_backprop_gpu';\n\nexport function conv3DBackpropInput(args: {\n inputs:  
Conv3DBackpropInputV2Inputs,\n attrs: Conv3DBackpropInputV2Attrs,\n backend: MathBackendWebGL\n})  
{\n const { inputs, backend, attrs } = args;\n const { dy, filter } = inputs;\n const { pad, strides, inputShape } =  
attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n inputShape, filter.shape as [number, number,  
number, number, number],\n strides, 1 /* dilations */, pad);\n\n const program = new  
Conv3DDerInputProgram(convInfo);\n\n return backend.runWebGLProgram(program, [dy, filter],  
'float32');\n}\n\nexport const conv3DBackpropInputConfig: KernelConfig = {\n kernelName:  
Conv3DBackpropInputV2,\n backendName: 'webgl',\n kernelFunc: conv3DBackpropInput as { } as  
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the  
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
License.\n *
```

```
=====\n\n*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { CHECK_NAN_SNIPPET_UNARY,  
unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';\n\nconst COS = CHECK_NAN_SNIPPET_UNARY +  
\n\n return cos(x);\n};\n\nexport const cos = unaryKernelFunc({ opSnippet: COS });\n\nexport const cosConfig:  
KernelConfig = {\n kernelName: Cos,\n backendName: 'webgl',\n kernelFunc: cos,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the  
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```


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```
=====  
*  
\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from  
 './kernel_utils/kernel_funcs_utils';\nconst COSH = `float e2x = exp(-x);\n return (e2x + 1.0 / e2x) /  
 2.0`;\nexport const cosh = unaryKernelFunc({ opSnippet: COSH });\nexport const coshConfig: KernelConfig  
 = {\n kernelName: Cosh,\n backendName: 'webgl',\n kernelFunc: cosh,\n};\n"/**\n * @license\n * Copyright  
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 governing permissions and\n * limitations under the License.\n *  
=====  
\n
```

```
*  
\nimport { GPGPUProgram } from './gpgpu_math';\nexport class CropAndResizeProgram implements  
 GPGPUProgram {\n variableNames = ['Image', 'Boxes', 'BoxInd'];\n outputShape: number[] = [];\n userCode:  
 string;\n constructor(\n imageShape: [number, number, number, number], boxShape: [number, number],\n cropSize: [number, number], method: 'bilinear'|'nearest',\n extrapolationValue: number) {\n const [batch,  
 imageHeight, imageWidth, depth] = imageShape;\n const [numBoxes, ] = boxShape;\n const [cropHeight,  
 cropWidth] = cropSize;\n this.outputShape = [numBoxes, cropHeight, cropWidth, depth];\n const methodId =  
 method === 'bilinear' ? 1 : 0;\n const [inputHeightFloat, inputWidthFloat] = [\n `_${imageHeight - 1}.0`,  
 `_${imageWidth - 1}.0`];\n const [heightRatio, heightScale, inY] = [cropHeight > 1 ?\n [\n `_${(imageHeight - 1) / (cropHeight - 1)}`,\n `(y2-y1) * height_ratio`,\n `y1*${inputHeightFloat} +  
 float(y)*(height_scale)`,\n ] : [\n `0.0`,\n `0.0`,\n `0.5 * (y1+y2) * ${inputHeightFloat}`,\br/> ];\n const [widthRatio, widthScale, inX] = [cropWidth > 1 ?\n [\n `_${(imageWidth - 1) / (cropWidth -  
 1)}`,\n `(x2-x1) * width_ratio`,\n `x1*${inputWidthFloat} + float(x)*(width_scale)`,\n ] : [\n `0.0`,\n `0.0`,\n `0.5 * (x1+x2) * ${inputWidthFloat}`,\br/> ];\n // Reference implementation\n //  
 tslint:disable-next-line:max-line-length\n //  
 https://github.com/tensorflow/tensorflow/blob/master/tensorflow/core/kernels/crop_and_resize_op_gpu.cu.cc\n this.userCode = `\n const float height_ratio = float(${heightRatio});\n const float width_ratio =  
 float(${widthRatio});\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int  
 y = coords[1];\n int x = coords[2];\n int d = coords[3];\n // get box vals\n float y1 =  
 getBoxes(b,0);\n float x1 = getBoxes(b,1);\n float y2 = getBoxes(b,2);\n float x2 = getBoxes(b,3);\n // get image in batch index\n int bInd = round(getBoxInd(b));\n if(bInd < 0 || bInd >= ${batch}) {\n return;\n }\n float height_scale = ${heightScale};\n float width_scale = ${widthScale};\n float  
 in_y = ${inY};\n if( in_y < 0.0 || in_y > ${inputHeightFloat} ) {\n setOutput(float(${extrapolationValue}));\n return;\n }\n float in_x = ${inX};\n if( in_x < 0.0 ||  
 in_x > ${inputWidthFloat} ) {\n setOutput(float(${extrapolationValue}));\n return;\n }\n vec2  
 sourceFracIndexCR = vec2(in_x,in_y);\n if(${methodId} == 1) {\n // Compute the four integer indices.\n ivec2 sourceFloorCR = ivec2(sourceFracIndexCR);\n ivec2 sourceCeilCR =  
 ivec2(ceil(sourceFracIndexCR));\n float topLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);\n float bottomLeft = getImage(b, sourceCeilCR.y, sourceFloorCR.x, d);\n float topRight = getImage(b,  
 sourceFloorCR.y, sourceCeilCR.x, d);\n float bottomRight = getImage(b, sourceCeilCR.y, sourceCeilCR.x,  
 d);\n vec2 fracCR = sourceFracIndexCR - vec2(sourceFloorCR);\n float top = topLeft + (topRight -  
 topLeft) * fracCR.x;\n float bottom = bottomLeft + (bottomRight - bottomLeft) * fracCR.x;\n float  
 newValue = top + (bottom - top) * fracCR.y;\n setOutput(newValue);\n } else {\n // Compute the  
 coordinators of nearest neighbor point.\n ivec2 sourceNearestCR = ivec2(floor(\n sourceFracIndexCR +  
 vec2(0.5,0.5)));  
 float newValue = getImage(b, sourceNearestCR.y, sourceNearestCR.x, d);\n setOutput(newValue);\n }\n }\n`;\n"/**\n * @license\n * Copyright 2020 Google LLC. All
```

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```
=====\n*\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {CropAndResizeProgram} from './crop_and_resize_gpu';\n\nexport const cropAndResize = (args: {\n  inputs: CropAndResizeInputs,\n  backend: MathBackendWebGL,\n  attrs: CropAndResizeAttrs\n}): TensorInfo => {\n  const {inputs, backend, attrs} = args;\n  const {image, boxes, boxInd} = inputs;\n  const {cropSize, method, extrapolationValue} = attrs;\n\n  const program = new CropAndResizeProgram(\n    image.shape as [number, number, number, number],\n    boxes.shape as [number, number], cropSize, method, extrapolationValue);\n  return backend.runWebGLProgram(program, [image, boxes, boxInd], 'float32');\n};\n\nexport const cropAndResizeConfig: KernelConfig = {\n  kernelName: CropAndResize,\n  backendName: 'webgl',\n  kernelFunc: cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class CumSumProgram implements GPGPUProgram {\n  variableNames = ['x'];\n  outputShape: number[];\n  userCode: string;\n\n  // Caching uniform location for speed.\n  index: WebGLUniformLocation;\n\n  constructor(shape: number[], exclusive: boolean, reverse: boolean) {\n    this.outputShape = shape;\n    const rank = shape.length;\n    const val = exclusive ? '0.0' : `getX(${getCoords(rank, 'coords')})`;\n    const length = shape[shape.length - 1];\n    let condition = \"\";\n    let idxString = \"\";\n    // When exclusive is set, the cumsum op becomes roll op that copies the\n    // value from the previous index based on the direction specified by the\n    // reverse flag.\n    if (exclusive) {\n      condition = reverse ? `end != ${length - 1}` : `end != 0`;\n      idxString = reverse ? `end + 1` : `end - 1`;\n    } else {\n      condition = reverse ? `end + pow2 < ${length}` : `end >= pow2`;\n      idxString = (reverse ? `end + pow2` : `end - pow2`);\n    }\n\n    this.userCode = `\n    uniform float index;\n    void main() {\n      ${getCoordsDataType(rank)} coords = getOutputCoords();\n      int end = ${getFinalCoord(rank, 'coords')};\n      float val = ${val};\n      int pow2 = int(pow(2.0, index));\n      if (${condition}) {\n        int idx = ${idxString};\n        ${getFinalCoord(rank, 'coords')} = idx;\n        val += getX(${getCoords(rank, 'coords')});\n      }\n      setOutput(val);\n    }\n  `;\n\n  getCustomSetupFunc(index: number) {\n    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n      if (this.index == null) {\n        this.index = gpgpu.getUniformLocation(webGLProgram, 'index');\n      }\n      gpgpu.gl.uniform1f(this.index, index);\n    }; \n  }\n\n  function getCoords(rank: number, name: string): string {\n    if (rank === 1) {\n      return `${name}`;\n    } else if (rank === 2) {\n      return `${name}.x, ${name}.y`;\n    } else if (rank === 3) {\n      return `${name}.x, ${name}.y, ${name}.z`;\n    } else if (rank === 4) {\n      return `${name}.x, ${name}.y, ${name}.z, ${name}.w`;\n    } else {\n      throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n    }\n  }\n\n  function getFinalCoord(rank: number, name: string): string {\n    if (rank === 1) {\n      return `${name}`;\n    } else if (rank === 2) {\n      return `${name}.y`;\n    } else if (rank === 3) {\n      return `${name}.z`;\n    } else if (rank === 4) {\n      return `${name}.w`;\n    } else {\n      throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n    }\n  }\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
```

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```
=====  
*\n\nimport { backend_util, Cumsum, CumsumAttrs, CumsumInputs, KernelConfig, KernelFunc, TensorInfo } from  
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport { CumSumProgram } from '../cumsum_gpu';\n\nimport { identity } from './Identity';\n\nimport { transpose } from './Transpose';\n\n\nexport function cumsum(\n  args: {\n    inputs: CumsumInputs, backend: MathBackendWebGL, attrs: CumsumAttrs});\n  TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { x } = inputs;\n    const { axis, exclusive, reverse } = attrs;\n\n    const xRank = x.shape.length;\n    const permutation = backend_util.getAxesPermutation([axis], xRank);\n    let permutedX = x;\n    if (permutation != null) {\n      permutedX = transpose({ inputs: { x }, backend, attrs: { perm: permutation });\n    }\n    const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n    if (permutedAxis !== xRank - 1) {\n      throw new Error(\n        `WebGL cumsum shader expects an inner-most axis=${x\n        x.shape.length - 1}` +\n        `but got axis=${axis}`);\n    }\n    const size = permutedX.shape[permutedAxis];\n    let result = identity({ inputs: { x: permutedX }, backend });\n    // Use cumsum parallel algorithm, ref: https://developer.nvidia.com/gpugems/gpugems3/part-vi-gpu-computing/chapter-39-parallel-prefix-sum-scan-cuda\n    for (let i = 0; i <= Math.ceil(Math.log2(size)) - 1; i++) {\n      const program = new CumSumProgram(permutedX.shape, false, reverse);\n      const customSetup = program.getCustomSetupFunc(i);\n      const prevResult = result;\n      result =\n        backend.runWebGLProgram(program, [result], result.dtype, customSetup);\n      backend.disposeIntermediateTensorInfo(prevResult);\n    }\n    // For exclusive cumsum, shift the end result in the direction of sum\n    // and add 0 to the front index.\n    if (exclusive) {\n      const program = new CumSumProgram(permutedX.shape, exclusive, reverse);\n      const prevResult = result;\n      result =\n        backend.runWebGLProgram(program, [result], result.dtype);\n      backend.disposeIntermediateTensorInfo(prevResult);\n    }\n    if (permutation != null) {\n      const reversePermutation = backend_util.getUndoAxesPermutation(permutation);\n      const reverseTransposedResult =\n        transpose(\n          { inputs: { x: result }, backend, attrs: { perm: reversePermutation } });\n      backend.disposeIntermediateTensorInfo(result);\n      backend.disposeIntermediateTensorInfo(permutedX);\n      return reverseTransposedResult;\n    }\n    return result;\n  }\n\n\nexport const cumsumConfig: KernelConfig = {\n  kernelName: Cumsum,\n  backendName: 'webgl',\n  kernelFunc: cumsum as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====  
*\n\nimport { DenseBincount, DenseBincountAttrs, DenseBincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport { bincountImplCPU, bincountReduceImplCPU } from '../kernel_utils/shared';\n\n\nexport function denseBincount(args: {\n  inputs: DenseBincountInputs,\n  backend: MathBackendWebGL,\n  attrs: DenseBincountAttrs});\n  TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { x, weights } = inputs;\n    const { size, binaryOutput } = attrs;\n\n    if (x.shape.length === 1) {\n      const xVals = backend.readSync(x.dataId) as TypedArray;\n      const weightsVals = backend.readSync(weights.dataId) as TypedArray;\n      const outVals =\n        bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape, size);\n      return backend.makeTensorInfo([size], weights.dtype, outVals);\n    } else if (x.shape.length === 2) {\n      const xBuf = backend.bufferSync(x);\n      const weightsBuf =
```

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backend.bufferSync(weights);\n\n  const outBuf = bincountReduceImplCPU(xBuf, weightsBuf, size,
binaryOutput);\n\n  return backend.makeTensorInfo(outBuf.shape, weights.dtype, outBuf.values);\n } \n\n throw
new Error(\n    `Error in denseBincount: input must be at most rank 2, but got rank` +\n
`${x.shape.length}.`);\n}\n\nexport const denseBincountConfig: KernelConfig = {\n  kernelName:
DenseBincount,\n  backendName: 'webgl',\n  kernelFunc: denseBincount as {} as KernelFunc\n};\n", "/*\n *
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=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class DepthToSpaceProgram implements
GPGPUProgram {\n  variableNames = ['x'];\n  outputShape: number[] = [];\n  userCode: string;\n  blockSize:
number;\n  dataFormat: string;\n\n  constructor(\n    outputShape: number[], blockSize: number, dataFormat:
'NHWC'|'NCHW') {\n    this.outputShape = outputShape;\n    this.blockSize = blockSize;\n    this.dataFormat =
dataFormat;\n    this.userCode = `\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int b =
coords[0];\n      int h = ${this.getHeightCoordString()};\n      int w = ${this.getWidthCoordString()};\n      int d =
${this.getDepthCoordString()};\n\n      int in_h = h / ${blockSize};\n      int offset_h = imod(h, ${blockSize});\n
int in_w = w / ${blockSize};\n      int offset_w = imod(w, ${blockSize});\n      int offset_d = (offset_h *
${blockSize} + offset_w) *\n      ${this.getOutputDepthSize()};\n      int in_d = d + offset_d;\n\n      float result =
${this.getInputSamplingString()};\n      setOutput(result);\n    }\n  ;\n }\n\n private getHeightCoordString(): string
{\n   if (this.dataFormat === 'NHWC') {\n     return `coords[1]`;\n   } else {\n     return `coords[2]`;\n   }\n }\n\n
private getWidthCoordString(): string {\n   if (this.dataFormat === 'NHWC') {\n     return `coords[2]`;\n   } else
{\n     return `coords[3]`;\n   }\n }\n\n private getDepthCoordString(): string {\n   if (this.dataFormat ===
'NHWC') {\n     return `coords[3]`;\n   } else {\n     return `coords[1]`;\n   }\n }\n\n private
getOutputDepthSize(): number {\n   if (this.dataFormat === 'NHWC') {\n     return this.outputShape[3];\n   } else
{\n     return this.outputShape[1];\n   }\n }\n\n private getInputSamplingString(): string {\n   if (this.dataFormat
=== 'NHWC') {\n     return `getX(b, in_h, in_w, in_d)`;\n   } else {\n     return `getX(b, in_d, in_h, in_w)`;\n   }\n
}\n}\n", "/*\n *
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=====\n
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from 'tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport
{DepthToSpaceProgram} from './depth_to_space_gpu';\n\nexport function depthToSpace(args: {\n  inputs:
DepthToSpaceInputs,\n  backend: MathBackendWebGL,\n  attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const
{inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {blockSize, dataFormat} = attrs;\n\n  util.assert(\n
blockSize > 1,\n    () => `blockSize should be > 1 for depthToSpace, but was: ${blockSize}`);\n\n  const batchSize
= x.shape[0];\n  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
: x.shape[1];\n\n  const outputHeight = inputHeight * blockSize;\n  const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n  const outputShape = (dataFormat === 'NHWC') ?\n
[batchSize, outputHeight, outputWidth, outputDepth] :\n  [batchSize, outputDepth, outputHeight,
outputWidth];\n\n  const program = new DepthToSpaceProgram(outputShape, blockSize, dataFormat);\n  return

```



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*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
 './gpgpu_math';\n\nexport class DepthwiseConvPacked2DProgram implements GPGPUProgram {\n  variableNames
= ['x', 'W'];\n  packedInputs = true;\n  packedOutput = true;\n  outputShape: number[];\n  userCode: string;\n\n  constructor(\n    convInfo: backend_util.Conv2DInfo, addBias = false,\n    activation: string = null,
hasPreluActivation = false,\n    hasLeakyReluAlpha = false) {\n    this.outputShape = convInfo.outShape;\n\n    const xNumRows = convInfo.inHeight;\n    const xNumCols = convInfo.inWidth;\n    const padTop =
convInfo.padInfo.top;\n    const padLeft = convInfo.padInfo.left;\n    const strideHeight = convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n    const dilationHeight = convInfo.dilationHeight;\n    const
dilationWidth = convInfo.dilationWidth;\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth =
convInfo.filterWidth;\n    const texelsAcross = filterWidth;\n\n    let mainLoop = `int xR; int xC; int xCOffset;`\n
for (let r = 0; r < filterHeight; r++) {\n    for (let c = 0; c < filterWidth; c++) {\n      mainLoop += `\n      vec4
xTexelR${r}C${c * 2} = vec4(0.);\n      vec4 wR${r}C${c} = vec4(0.);\n      vec4 xR${r}C${c} = vec4(0.);`\n
    }\n  }\n  /**\n   * This vectorized implementation works by gathering the values needed for\n   * each
output channel's dot product into vec4's and then multiplying them\n   * all together (this happens in the final
double for-loop below). Most of\n   * the main loop consists of constructing these vec4's with the minimum\n   *
number of texture2D calls, which means making use of all four returned\n   * values from a texture2D call at
once.\n   *\n   * for (let r = 0; r < filterHeight; r++) {\n    for (let texelC = 0; texelC < texelsAcross; texelC++) {\n
      const c = texelC * 2;\n\n      mainLoop += `\n        xR = xRCorner + ${r * dilationHeight};\n        xC =
xCCorner + ${c * dilationWidth};\n        `;\n\n      if (strideWidth === 1) {\n        if (c < filterWidth) {\n          //
If padding is odd, the outer texels have to be composed.\n          if (padLeft % 2 === 1) {\n            // TODO:
Ensure vec4 previous does not result in redundant sample,\n            // and avoid setting xTexelRC's that exceed the
boundary in the\n            // first place rather than resetting them to vec4(0)).\n\n            // To compute xCOffset:\n
          // - If padding is odd, we must add 1 to ensure we ask for an\n            // even-numbered row.\n            // -
We subtract 2 to access the previous texel.\n\n            mainLoop += `\n              xCOffset = xC + 1;\n
if(xR >= 0 && xR < ${xNumRows} && xCOffset >= 0 && xCOffset < ${\n              xNumCols}) {\n
xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);\n\n              // Need to manually clear unused channels in
case\n              // we're reading from recycled texture.\n              if(xCOffset + 1 >= ${xNumCols}) {\n
xTexelR${r}C${c}.zw = vec2(0.);}\n              } else {\n                xTexelR${r}C${c} = vec4(0.);}\n
              }\n\n              xCOffset = xC + 1 - 2;\n              if(xR >= 0 && xR < ${xNumRows} && xCOffset >= 0
&& xCOffset < ${\n                xNumCols}) {\n                  vec4 previous = getX(batch, xR, xCOffset, d1);\n
              // Need to manually clear unused channels in case\n              // we're reading from recycled texture.\n
if(xCOffset + 1 >= ${xNumCols}) {\n                previous.zw = vec2(0.);}\n              }\n\n              xR${r}C${c} =
vec4(previous.zw, xTexelR${r}C${c}.xy);\n              } else {\n                xR${r}C${c} = vec4(0,
0, xTexelR${r}C${c}.xy);\n              }\n              `;\n              } else {\n                // Padding is even, so xRC
corresponds to a single texel.\n                mainLoop += `\n                  if(xR >= 0 && xR < ${xNumRows} && xC >=
0 && xC < ${xNumCols}) {\n                    xTexelR${r}C${c} = getX(batch, xR, xC, d1);\n                  } else {\n
                    xTexelR${r}C${c} = vec4(0.);}\n                  }\n\n                  xR${r}C${c} = xTexelR${r}C${c};\n                  `;\n
              }\n              if (c + 1 < filterWidth) {\n                // If dilation is even, the second entry should match the first\n
                // (either both are composed or both are single samples). But if\n                // dilation is odd, then the second entry
should be the opposite\n                // of the first (if the first is composed, the second is a single\n                // sample,
and vice versa.)\n\n                const nextTexelOffset = padLeft % 2 === 0 ?\n                util.nearestLargerEven(dilationWidth) : \n                dilationWidth;\n\n                if ((dilationWidth % 2 === 0 &&
padLeft % 2 === 1) ||\n                (dilationWidth % 2 !== 0 && padLeft % 2 !== 1)) {\n                  mainLoop += `\n
                  xCOffset = xC + ${padLeft % 2} + ${nextTexelOffset};\n                  if(xR >= 0 && xR <
${xNumRows} &&\n                  xCOffset >= 0 && xCOffset < ${xNumCols}) {\n                    xTexelR${r}C${c}
+ 2} = getX(batch, xR, xCOffset, d1);\n                  }\n                  `;\n                  // If dilation > 1 then the xRC's will
not be able to share any\n                  // values, so each xRC will require two unique calls to getX.\n                  if
(dilationWidth > 1) {\n                    mainLoop += `\n                      xCOffset -= 2;\n                      if(xR >= 0 && xR <

```



```
vec4 result = dotProd;\n    ${addBiasSnippet}\n    ${applyActivationSnippet}\n    setOutput(result);\n    }\n};\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,\nDepthwiseConv2dNativeInputs, env, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport\n{MathBackendWebGL} from './backend_webgl';\nimport {DepthwiseConv2DProgram} from\n './conv_gpu_depthwise';\nimport {DepthwiseConvPacked2DProgram} from\n './conv_packed_gpu_depthwise';\n\nexport function depthwiseConv2dNative(args: {\n inputs:\nDepthwiseConv2dNativeInputs,\n attrs: DepthwiseConv2dNativeAttrs,\n backend: MathBackendWebGL\n}) {\n\nconst {inputs, backend, attrs} = args;\nconst {x, filter} = inputs;\nconst {strides, pad, dilations,\ndimRoundingMode} = attrs;\n\nlet $dilations = dilations;\nif ($dilations == null) {\n  $dilations = [1, 1];\n}\n\nutil.assert(\n  backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),\n  () => 'Error in\ndepthwiseConv2d: Either strides or dilations must be '+\n  `1. Got strides ${strides} and dilations\n'${$dilations}`);\n\nconst convInfo = backend_util.computeConv2DInfo(\n  x.shape as [number, number,\nnumber, number],\n  filter.shape as [number, number, number, number],\n  strides, $dilations,\n  pad,\ndimRoundingMode, true /* depthwise */);\n\nlet program:\nDepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n\nif\n(env().getBool('WEBGL_PACK_DEPTHWISECONV') && convInfo.strideWidth <= 2 &&\nconvInfo.outChannels / convInfo.inChannels === 1) {\n  program = new\nDepthwiseConvPacked2DProgram(convInfo);\n} else {\n  program = new\nDepthwiseConv2DProgram(convInfo);\n}\n\nreturn backend.runWebGLProgram(program, [x, filter],\n'float32');\n}\n\nexport const depthwiseConv2dNativeConfig: KernelConfig = {\n  kernelName:\nDepthwiseConv2dNative,\n  backendName: 'webgl',\n  kernelFunc: depthwiseConv2dNative as {\n} as\nKernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n './gpgpu_math';\n\nexport class DepthwiseConv2DDerFilterProgram implements GPGPUProgram {\n\nvariableNames = ['x', 'dy'];\noutputShape: number[];\nuserCode: string;\n\nconstructor(convInfo:\nbackend_util.Conv2DInfo) {\n  this.outputShape = convInfo.filterShape;\n\nconst strideHeight =\nconvInfo.strideHeight;\nconst strideWidth = convInfo.strideWidth;\nconst padTop = convInfo.padInfo.top;\nconst padLeft = convInfo.padInfo.left;\nconst channelMul = convInfo.outChannels / convInfo.inChannels;\n\nthis.userCode = `\nvoid main() {\n  ivec4 coords = getOutputCoords();\n  int wR = coords.x;\n  int\nwC = coords.y;\n  int d1 = coords.z;\n  int dm = coords.w;\n  int d2 = d1 * ${channelMul} + dm;\n\nfloat dotProd = 0.0;\n  // TO DO: Vec4 over the batch size\n  for (int b = 0; b < ${convInfo.batchSize};\nb++) {\n    for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n      int xR = wR + yR * ${strideHeight} -\n${padTop};\n      if (xR < 0 || xR >= ${convInfo.inHeight}) {\n        continue;\n      }\n      for (int`
```



```

yC = 0; yC < ${convInfo.outWidth}; yC++) {\n          int xC = wC + yC * ${strideWidth} - ${padLeft};\n\n          if (xC < 0 || xC >= ${convInfo.inWidth}) {\n              continue;\n          }\n          float dyValue = getDy(b,\n          yR, yC, d2);\n          float xValue = getX(b, xR, xC, d1);\n          dotProd += (xValue * dyValue);\n      }\n  }\n  setOutput(dotProd);\n  }\n  `;\n}\n}\n\nexport class DepthwiseConv2DDerInputProgram\nimplements GPGPUProgram {\n  variableNames = ['dy', 'W'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv2DInfo) {\n    this.outputShape = convInfo.inShape;\n\n    const\n    filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const strideHeight =\n    convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n\n    const padTop = filterHeight - 1 -\n    convInfo.padInfo.top;\n    const padLeft = filterWidth - 1 - convInfo.padInfo.left;\n    const channelMul =\n    convInfo.outChannels / convInfo.inChannels;\n\n    this.userCode = `\n    const ivec2 pads = ivec2(${padTop},\n    ${padLeft});\n\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int batch = coords[0];\n      int\n      d1 = coords[3];\n      ivec2 dyCorner = coords.yz - pads;\n      int dyRCorner = dyCorner.x;\n      int dyCCorner =\n      dyCorner.y;\n\n      float dotProd = 0.0;\n\n      for (int wR = 0; wR < ${filterHeight}; wR++) {\n        float dyR\n        = float(dyRCorner + wR) / ${strideHeight}.0;\n\n        if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n        fract(dyR) > 0.0) {\n          continue;\n        }\n        int idyR = int(dyR);\n        int wRPerm = ${filterHeight} -\n        1 - wR;\n\n        for (int wC = 0; wC < ${filterWidth}; wC++) {\n          float dyC = float(dyCCorner + wC) /\n          ${strideWidth}.0;\n\n          if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n          fract(dyC) > 0.0) {\n            continue;\n          }\n          int idyC = int(dyC);\n          int wCPerm = ${filterWidth} - 1 - wC;\n\n          //\n          TO DO: Vec4 over the channelMul\n          for (int dm = 0; dm < ${channelMul}; dm++) {\n            int d2 = d1 *\n            ${channelMul} + dm;\n            float xValue = getDy(batch, idyR, idyC, d2);\n            float wValue =\n            getW(wRPerm, wCPerm, d1, dm);\n            dotProd += xValue * wValue;\n          }\n        }\n      }\n      setOutput(dotProd);\n    }\n  `;\n}\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\nimport {backend_util, DepthwiseConv2dNativeBackpropFilter, DepthwiseConv2dNativeBackpropFilterAttrs,\nDepthwiseConv2dNativeBackpropFilterInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n{MathBackendWebGL} from './backend_webgl';\nimport {DepthwiseConv2DDerFilterProgram} from\n './conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropFilter(args: {\n  inputs:\n  DepthwiseConv2dNativeBackpropFilterInputs,\n  attrs: DepthwiseConv2dNativeBackpropFilterAttrs,\n  backend:\n  MathBackendWebGL\n}) {\n  const {inputs, backend, attrs} = args;\n  const {x, dy} = inputs;\n  const {strides,\n  dilations, pad, dimRoundingMode, filterShape} = attrs;\n\n  const convInfo = backend_util.computeConv2DInfo(\n  x.shape as [number, number, number, number], filterShape, strides,\n  dilations, pad, dimRoundingMode, true /*\n  depthwise */);\n\n  const program = new DepthwiseConv2DDerFilterProgram(convInfo);\n  return\n  backend.runWebGLProgram(program, [x, dy], 'float32');\n}\n\nexport const\ndepthwiseConv2dNativeBackpropFilterConfig: KernelConfig = {\n  kernelName:\n  DepthwiseConv2dNativeBackpropFilter,\n  backendName: 'webgl',\n  kernelFunc:\n  depthwiseConv2dNativeBackpropFilter as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n
```

```

=====
*\n\nimport {backend_util, DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,
DepthwiseConv2dNativeBackpropInputInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {DepthwiseConv2DDerInputProgram} from
'./conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropInput(args: {\n inputs:
DepthwiseConv2dNativeBackpropInputInputs,\n attrs: DepthwiseConv2dNativeBackpropInputAttrs,\n backend:
MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const {strides,
dilations, pad, dimRoundingMode, inputShape} = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
true /* depthwise */);\n\n const program = new DepthwiseConv2DDerInputProgram(convInfo);\n return
backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeBackpropInputConfig: KernelConfig = {\n kernelName:
DepthwiseConv2dNativeBackpropInput,\n backendName: 'webgl',\n kernelFunc:
depthwiseConv2dNativeBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class DiagProgram implements GPGPUProgram
{\n variableNames = ['X'];\n outputShape: number[];\n userCode: string;\n\n constructor(size: number) {\n
this.outputShape = [size, size];\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n
float val = coords[0] == coords[1] ? getX(coords[0]) : 0.0;\n  setOutput(val);\n }\n `;\n }\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {Diag, DiagInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {DiagProgram} from
'./diag_gpu';\n\nimport {reshape} from './Reshape';\n\nexport function diag(args: {inputs: DiagInputs, backend:
MathBackendWebGL}):\n TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n const
outShape = [...x.shape, ...x.shape];\n const xSize = util.sizeFromShape(x.shape);\n\n const flat = reshape({inputs:
{x}, backend, attrs: {shape: [xSize]}});\n\n const program = new DiagProgram(xSize);\n const res =
backend.runWebGLProgram(program, [flat], flat.dtype);\n\n const out = reshape({inputs: {x: res}, backend, attrs:
{shape: outShape}});\n\n backend.disposeIntermediateTensorInfo(flat);\n
backend.disposeIntermediateTensorInfo(res);\n\n return out;\n}\n\nexport const diagConfig: KernelConfig = {\n
kernelName: Diag,\n backendName: 'webgl',\n kernelFunc: diag as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Dilation2DProgram implements GPGPUProgram {\n  variableNames = ['x', 'W'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo: backend_util.Conv2DInfo) {\n    this.outputShape = convInfo.outShape;\n\n    const {\n      inHeight,\n      inWidth,\n      padInfo,\n      strideHeight,\n      strideWidth,\n      filterHeight,\n      filterWidth,\n      dilationHeight,\n      dilationWidth\n    } = convInfo;\n\n    const {top: padTop, left: padLeft} = padInfo;\n\n    this.userCode = `\n      const ivec2 strides =
ivec2(${strideHeight}, ${strideWidth});\n      const ivec2 pads = ivec2(${padTop}, ${padLeft});\n      const float
neg_infinity = -3.4e38;\n      void main() {\n        ivec4 coords = getOutputCoords();\n        int batch = coords.x;\n        int d1 = coords.w;\n        ivec2 outTopLeftCorner =\n          coords.yz * strides - pads;\n        int hBeg =
outTopLeftCorner.x;\n        int wBeg = outTopLeftCorner.y;\n\n        float curVal = neg_infinity;\n        for (int h =
0; h < ${filterHeight}; h++) {\n          int hIn = hBeg + h * ${dilationHeight};\n          if (hIn >= 0 && hIn <
${inHeight}) {\n            for (int w = 0; w < ${filterWidth}; w++) {\n              int wIn = wBeg + w *
${dilationWidth};\n              if (wIn >= 0 && wIn < ${inWidth}) {\n                float xVal = getX(batch, hIn, wIn,
d1);\n                float wVal = getW(h, w, d1);\n                float val = xVal + wVal;\n                if (val > curVal) {\n
                  curVal = val;\n                }\n              }\n            }\n          }\n\n          float result = curVal;\n          setOutput(result);\n        }\n      }\n    `;\n  }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {backend_util, Dilation2D, Dilation2DAttrs, Dilation2DInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Dilation2DProgram} from './dilation_gpu';\nimport {reshape} from './Reshape';\n\nexport function
dilation2D(args: {\n  inputs: Dilation2DInputs,\n  attrs: Dilation2DAttrs,\n  backend: MathBackendWebGL\n}) {\n
  const {inputs, backend, attrs} = args;\n  const {x, filter} = inputs;\n  const {strides, pad, dilations} = attrs;\n\n  const
convInfo = backend_util.computeDilation2DInfo(\n    x.shape as [number, number, number, number],\n    filter.shape as [number, number, number],\n    strides, pad,\n    'NHWC' /* dataFormat */,\n    dilations);\n\n  let out:
TensorInfo;\n\n  const program = new Dilation2DProgram(convInfo);\n  out =
backend.runWebGLProgram(program, [x, filter], 'float32');\n\n  const outReshaped =\n    reshape({inputs: {x: out},\n      backend, attrs: {shape: convInfo.outShape}});\n\n  backend.disposeIntermediateTensorInfo(out);\n\n  return
outReshaped;\n}\n\nexport const dilation2DConfig: KernelConfig = {\n  kernelName: Dilation2D,\n  backendName:
'webgl',\n  kernelFunc: dilation2D as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {Elu, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst ELU = `return (x >= 0.0) ? x : (exp(x) - 1.0);`\n\nconst ELU_PACKED
= `\n  vec4 result;\n\n  result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);\n  result.g = (x.g >= 0.0) ? x.g : (exp(x.g) -
1.0);\n  result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n  result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n\n  return
result;\n`;\n\nconst elu = unaryKernelFunc({opSnippet: ELU, packedOpSnippet: ELU_PACKED});\n\nexport const

```

```

eluConfig: KernelConfig = {\n kernelName: Elu,\n backendName: 'webgl',\n kernelFunc: elu as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

===== \n
*\n\nimport {EluGrad, EluGradInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {BinaryOpProgram} from
'./binaryop_gpu';\nimport {BinaryOpPackedProgram} from './binaryop_packed_gpu';\n\nconst ELU_DER = `return
(b >= 1.0) ? a : a * (b + 1.0);`\n\nconst ELU_DER_PACKED = `\n  vec4 bGTEZero = vec4(greaterThanEqual(b,
vec4(0.0))); \n  return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0)))));\n`; \n\n\nexport const eluGrad
=\n  (args: {inputs: EluGradInputs, backend: MathBackendWebGL}): TensorInfo => {\n    const {inputs,
backend} = args;\n    const {dy, y} = inputs;\n\n    const program =
env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n      new
BinaryOpPackedProgram(ELU_DER_PACKED, dy.shape, y.shape) :\n      new BinaryOpProgram(ELU_DER,
dy.shape, y.shape);\n    return backend.runWebGLProgram(program, [dy, y], dy.dtype);\n  };\n\n\nexport const
eluGradConfig: KernelConfig = {\n  kernelName: EluGrad,\n  backendName: 'webgl',\n  kernelFunc: eluGrad as { }
as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

===== \n
*\n\nimport {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst PACKED_EQUAL = `\n  return vec4(equal(a, b));\n`; \n\n\nconst EQUAL
= `return float(a == b);`\n\n\nexport const equal = binaryKernelFunc(\n  {opSnippet: EQUAL, packedOpSnippet:
PACKED_EQUAL, dtype: 'bool'});\n\n\nexport const equalConfig: KernelConfig = {\n  kernelName: Equal,\n  backendName: 'webgl',\n  kernelFunc: equal as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

===== \n
*\n\nimport {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst ERF = `\n // Error function is calculated approximately with elementary
function.\n // See \"Handbook of Mathematical Functions with Formulas,\n // Graphs, and Mathematical Tables\",
Abramowitz and Stegun.\n float p = ${backend_util.ERF_P};\n float a1 = ${backend_util.ERF_A1};\n float a2 =
${backend_util.ERF_A2};\n float a3 = ${backend_util.ERF_A3};\n float a4 = ${backend_util.ERF_A4};\n float
a5 = ${backend_util.ERF_A5};\n\n float sign = sign(x);\n x = abs(x);\n float t = 1.0 / (1.0 + p * x);\n return sign *
(1.0 - (((((a5*t + a4)*t) + a3)*t + a2)*t + a1)*t*exp(-x*x));\n`; \n\n\nexport const erf = unaryKernelFunc({opSnippet:
ERF});\n\n\nexport const erfConfig: KernelConfig = {\n  kernelName: Erf,\n  backendName: 'webgl',\n  kernelFunc:

```

erf,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n  inputs: ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: MathBackendWebGL\n}): TensorInfo {\n  const {inputs, attrs, backend} = args;\n  const {dim} = attrs;\n  const {input} = inputs;\n  const inputRank = input.shape.length;\n  const newShape = input.shape.slice();\n  let $dim = dim;\n  if (dim < 0) {\n    // Negative value is counted from the tail of rank.\n    util.assert(\n      -(inputRank + 1) <= dim,\n      () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n        inputRank\n      }]);\n    $dim = inputRank + dim + 1;\n  }\n  newShape.splice($dim, 0, 1);\n  return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n  kernelName: ExpandDims,\n  backendName: 'webgl',\n  kernelFunc: expandDims as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FFTProgram implements GPGPUProgram {\n  variableNames = ['real', 'imag'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(\n    component: 'real'|'imag',\n    inputShape: [number, number],\n    inverse: boolean) {\n    const innerDim = inputShape[1];\n    this.outputShape = inputShape;\n\n    const exponentMultiplierSnippet =\n      inverse ? `2.0 * ${Math.PI}` : `-.2.0 * ${Math.PI}`;\n    const resultDenominator = inverse ? `${innerDim}.0` : '1.0';\n\n    let opString: string;\n    if (component === 'real') {\n      opString = 'return real * expR - imag * expI;'\n    } else if (component === 'imag') {\n      opString = 'return real * expI + imag * expR;'\n    } else {\n      throw new Error(`FFT component must be either \"real\" or \"imag\", got ${component}.`);\n    }\n\n    this.userCode = `\n    const float exponentMultiplier = ${exponentMultiplierSnippet};\n    float unaryOpComplex(float real, float expR, float imag, float expI) {\n      ${opString}\n    }\n\n    float mulMatDFT(int batch, int index) {\n      float indexRatio = float(index) / float(${innerDim});\n      float exponentMultiplierTimesIndexRatio =\n        exponentMultiplier * indexRatio;\n\n      float result = 0.0;\n      for (int i = 0; i < ${innerDim}; i++) {\n        // x = (-2|2 * PI / N) * index * i;\n        float x = exponentMultiplierTimesIndexRatio * float(i);\n        float expR = cos(x);\n        float expI = sin(x);\n        float real = getReal(batch, i);\n        float imag = getImag(batch, i);\n        result +=\n          unaryOpComplex(real, expR, imag, expI) / ${resultDenominator};\n      }\n      return result;\n    }\n\n    void main() {\n      ivec2 coords = getOutputCoords();\n      setOutput(mulMatDFT(coords[0], coords[1]));\n    }\n  `;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```

*\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {FFTProgram} from './fft_gpu';\n\nimport {complex} from './Complex';\n\nimport
{reshape} from './Reshape';\n\nexport function fftImpl(\n  x: TensorInfo, inverse: boolean, backend:
MathBackendWebGL): TensorInfo {\n  const xData = backend.texData.get(x.dataId);\n\n  const inputSize =
util.sizeFromShape(x.shape);\n  // Collapse all outer dimensions to a single batch dimension.\n  const
innerDimensionSize = x.shape[x.shape.length - 1];\n  const batch = inputSize / innerDimensionSize;\n\n  const
input2D = reshape(\n    {inputs: {x}, backend, attrs: {shape: [batch, innerDimensionSize]}});\n\n  const xShape =
input2D.shape as [number, number];\n  const realProgram = new FFTProgram('real', xShape, inverse);\n  const
imagProgram = new FFTProgram('imag', xShape, inverse);\n\n  const inputs = [\n    {\n      dataId:
xData.complexTensorInfos.real.dataId,\n      dtype: xData.complexTensorInfos.real.dtype,\n      shape: xShape\n
    },\n    {\n      dataId: xData.complexTensorInfos.imag.dataId,\n      dtype: xData.complexTensorInfos.imag.dtype,\n
      shape: xShape\n    }\n  ];\n\n  const realPart = backend.runWebGLProgram(realProgram, inputs, 'float32');\n  const
imagPart = backend.runWebGLProgram(imagProgram, inputs, 'float32');\n\n  const complexOutput =\n  complex({inputs: {real: realPart, imag: imagPart}, backend});\n\n  backend.disposeIntermediateTensorInfo(realPart);\n  backend.disposeIntermediateTensorInfo(imagPart);\n\n  const
complexOutputReshaped =\n    reshape({inputs: {x: complexOutput}, backend, attrs: {shape: x.shape}});\n\n  backend.disposeIntermediateTensorInfo(input2D);\n  backend.disposeIntermediateTensorInfo(complexOutput);\n\n  return complexOutputReshaped;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {FFT, FFTInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\n\nimport {fftImpl} from './FFT_impl';\n\nexport function
fft(args: {inputs: FFTInputs, backend: MathBackendWebGL}): TensorInfo {\n  const {inputs, backend} =
args;\n  const {input} = inputs;\n\n  return fftImpl(input, false /* inverse */, backend);\n}\n\nexport const fftConfig:
KernelConfig = {\n  kernelName: FFT,\n  backendName: 'webgl',\n  kernelFunc: fft;\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class FillProgram implements GPGPUProgram {\n  variableNames: string[];\n  outputShape: number[] = [];\n  userCode:
string;\n\n  valueLoc: WebGLUniformLocation;\n\n  constructor(shape: number[], value: number) {\n    this.variableNames = ['x'];\n    this.outputShape = shape;\n\n    this.userCode = `\n    uniform float value;\n    void
main() {\n      // Input can be obtained from uniform value.\n      setOutput(value);\n    }\n  `;\n\n  getCustomSetupFunc(value: number) {\n    return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) =>
{\n      if (this.valueLoc == null) {\n        this.valueLoc = gpgpu.getUniformLocationNoThrow(webGLProgram,
'value');\n      }\n      gpgpu.gl.uniform1f(this.valueLoc, value);\n    };}\n}\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {Fill, FillAttrs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {FillProgram} from '../fill_gpu';\n\nexport function fill(args: {backend: MathBackendWebGL, attrs: FillAttrs}):\n  TensorInfo {\n    const {backend, attrs} = args;\n    const {shape, value} = attrs;\n    let {dtype} = attrs;\n\n    dtype = dtype || util.inferDType(value);\n\n    if (dtype === 'string') {\n      // String type should be handled in CPU memory.\n      const values = util.getArrayFromDType(dtype, util.sizeFromShape(shape));\n      values.fill(value as string);\n      return backend.makeTensorInfo(shape, dtype, values);\n    } else {\n      const program = new FillProgram(shape, value as number);\n      const customSetup = program.getCustomSetupFunc(value as number);\n      return backend.runWebGLProgram(program, [], dtype, customSetup);\n    }\n  }\n\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName: 'webgl',\n  kernelFunc: fill as {} as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FlipLeftRightProgram implements GPGPUProgram {\n  variableNames = ['Image'];\n  outputShape: number[] = [];\n  userCode: string;\n\n  constructor(imageShape: [number, number, number, number]) {\n    const imageWidth = imageShape[2];\n    this.outputShape = imageShape;\n\n    this.userCode = `\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int x = coords[2];\n      int coordX = ${imageWidth} - x;\n      float\n      outputValue;\n      if(coordX >= 0 && coordX < ${imageWidth}) {\n        outputValue = getImage(coords[0], coords[1], coordX, coords[3]);\n      } else {\n        outputValue = getImage(coords[0], coords[1], coords[2], coords[3]);\n      }\n      setOutput(outputValue);\n    }\n  `;\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\nimport {FlipLeftRight, FlipLeftRightInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {FlipLeftRightProgram} from '../flip_left_right_gpu';\n\nexport const flipLeftRightConfig: KernelConfig = {\n  kernelName: FlipLeftRight,\n  backendName: 'webgl',\n  kernelFunc: ({inputs, backend}) => {\n    const {image} = inputs as FlipLeftRightInputs;\n    const webglBackend = backend as MathBackendWebGL;\n    const program = new FlipLeftRightProgram((image as Tensor4D).shape);\n    const output = webglBackend.runWebGLProgram(program, [image], image.dtype);\n    return output;\n  };\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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the specific language governing permissions and limitations under the License.

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=====
*\n\nimport {FloorDiv, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\n// We use native integer division to deal with floating point imprecision. Since we implement floor division and glsl implements truncated division, we correct for this by subtracting 1 from result when the result is negative and there is a remainder.\n\nconst INT_DIV = `float s = sign(a) * sign(b);\nint ia = round(a);\nint ib = round(b);\nif (ib != 0) {\n  // Windows (D3D) wants guaranteed non-zero int division at compile-time.\n  return float(idiv(ia, ib, s));\n} else {\n  return NAN;\n}`;\n\nconst INT_DIV_PACKED = `ivec4 ia = round(a);\nivec4 ib = round(b);\nivec4 cond = notEqual(ib, ivec4(0));\nivec4 result = ivec4(0);\nvec4 s = sign(a) * sign(b);\n\n// Windows (D3D) wants guaranteed non-zero int division at compile-time.\nif (cond[0]) {\n  result[0] = idiv(ia[0], ib[0], s[0]);\n}\nif (cond[1]) {\n  result[1] = idiv(ia[1], ib[1], s[1]);\n}\nif (cond[2]) {\n  result[2] = idiv(ia[2], ib[2], s[2]);\n}\nif (cond[3]) {\n  result[3] = idiv(ia[3], ib[3], s[3]);\n}\nreturn vec4(result);\n`;\n\nexport const floorDiv = binaryKernelFunc({opSnippet: INT_DIV, packedOpSnippet: INT_DIV_PACKED, dtype: 'int32'});\n\nexport const floorDivConfig: KernelConfig = {\n  kernelName: FloorDiv,\n  backendName: 'webgl',\n  kernelFunc: floorDiv as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n`;\n\n=====
```

```
*\n\nimport {getGlslDifferences} from '../glsl_version';\n\nimport {GPGPUProgram} from '../gpgpu_math';\n\nexport class FromPixelsProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  userCode: string;\n  outputShape: number[];\n\n  constructor(outputShape: number[]) {\n    const glsl = getGlslDifferences();\n    const [height, width, ] = outputShape;\n    this.outputShape = outputShape;\n\n    this.userCode = `void main() {\n  ivec3 coords = getOutputCoords();\n  int texR = coords[0];\n  int texC = coords[1];\n  int depth = coords[2];\n  vec2 uv = (vec2(texC, texR) + halfCR) / vec2(${width}.0, ${height}.0);\n\n  vec4 values = ${glsl.texture2D}(A, uv);\n  float value;\n  if (depth == 0) {\n    value = values.r;\n  } else if (depth == 1) {\n    value = values.g;\n  } else if (depth == 2) {\n    value = values.b;\n  } else if (depth == 3) {\n    value = values.a;\n  }\n\n  setOutput(floor(value * 255.0 + 0.5));\n}\n`;\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n`;\n\n=====
```

```
*\n\nimport {getGlslDifferences} from '../glsl_version';\n\nimport {GPGPUProgram} from '../gpgpu_math';\n\nexport class FromPixelsPackedProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  userCode: string;\n  outputShape: number[];\n  packedInputs = false;\n  packedOutput = true;\n\n  constructor(outputShape: number[]) {\n    const glsl = getGlslDifferences();\n    const [height, width, ] = outputShape;\n    this.outputShape = outputShape;\n\n    this.userCode = `void main() {\n  ivec3 coords = getOutputCoords();\n  int texR = coords[0];\n  int texC = coords[1];\n  int depth = coords[2];\n\n  vec4 result = vec4(0.);\n  for(int row=0; row<=1; row++) {\n    for(int col=0; col<=1; col++) {\n      texC = coords[1] + row;\n      depth = coords[2] + col;\n\n      vec2 uv = (vec2(texC, texR) + halfCR) /\n        vec2(${width}.0, ${height}.0);\n\n      vec4 values = ${glsl.texture2D}(A, uv);\n      float value;\n`;\n\n=====
```



```

FusedConv2DInputs,\n attrs: FusedConv2DAttrs,\n backend: MathBackendWebGL\n)) {\n const {inputs,\n backend, attrs} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const\n $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo =\n backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as\n [number, number, number, number], strides, dilations, pad,\n dimRoundingMode, false /* depthwise */,\n $dataFormat);\n let out: TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n if (convInfo.filterHeight === 1\n && convInfo.filterWidth === 1 &&\n convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\n convInfo.strideHeight === 1 && convInfo.strideWidth === 1 &&\n (convInfo.padInfo.type === 'SAME' ||\n convInfo.padInfo.type === 'VALID')) {\n out = conv2dByMatMul({\n x,\n filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else if\n (env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n out = conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else {\n const hasBias = bias != null;\n const hasPreluActivationWeights = preluActivationWeights !=\n null;\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n const fusedActivation =\n activation ?\n mapActivationToShaderProgram(activation, false) : null;\n const program = new Conv2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n const inputs:\n TensorInfo[] = [x, filter];\n if (bias) {\n inputs.push(bias);\n }\n if (preluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha =\n backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32',\n 'float32'));\n inputs.push($leakyreluAlpha);\n intermediates.push($leakyreluAlpha);\n }\n out =\n backend.runWebGLProgram(program, inputs, 'float32');\n }\n\n const outReshaped =\n reshape({inputs: {x:\n out}, backend, attrs: {shape: convInfo.outShape}});\n\n intermediates.push(out);\n intermediates.forEach(t =>\n backend.disposeIntermediateTensorInfo(t));\n\n return outReshaped;\n }\n\n\nexport const fusedConv2DConfig:\n KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'webgl',\n kernelFunc: fusedConv2d as {} as\n KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
=====
*/\n\nimport {backend_util, env, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,\n FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-\ncore';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {DepthwiseConv2DProgram} from\n './conv_gpu_depthwise';\nimport {DepthwiseConvPacked2DProgram} from\n './conv_packed_gpu_depthwise';\nimport {mapActivationToShaderProgram} from\n './kernel_utils/kernel_funcs_utils';\n\nexport function fusedDepthwiseConv2D(args: {\n inputs:\n FusedDepthwiseConv2DInputs,\n attrs: FusedDepthwiseConv2DAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {strides,\n pad, dilations, dimRoundingMode, activation, leakyreluAlpha} =\n attrs;\n\n const intermediates: TensorInfo[] =\n [];\n\n let $dilations = dilations;\n if ($dilations == null) {\n $dilations = [1, 1];\n }\n\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),\n () => 'Error in depthwiseConv2d: Either\n strides or dilations must be '\n `1. Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =\n backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as\n [number, number, number, number], strides, $dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const shouldPackDepthwiseConv = env().getBool('WEBGL_PACK_DEPTHWISECONV') &&\n

```



```

backend.disposeIntermediateTensorInfo(t));\n\n return backend.makeTensorInfo(\n  shapeInfo.outputShape,
outBuf.dtype, outBuf.values as TypedArray);\n }\n\n const program = new GatherProgram(flattenX.shape,
flattenOutputShape);\n const res = backend.runWebGLProgram(\n  program, [flattenX, flattenIndex],
flattenX.dtype);\n toDispose.push(res);\n\n const reshaped = reshape(\n  {inputs: {x: res}}, backend, attrs:
{shape: shapeInfo.outputShape});\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return
reshaped);\n\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName:
'webgl',\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { GreaterEqual, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { binaryKernelFunc }
from './kernel_utils/kernel_funcs_utils';\n\nconst GREATER_EQUAL = `return float(a >= b);`\nconst
GREATER_EQUAL_PACKED = `\n return vec4(greaterThanEqual(a, b));\n`;\n\n\nexport const greaterEqual =
binaryKernelFunc({\n opSnippet: GREATER_EQUAL,\n packedOpSnippet: GREATER_EQUAL_PACKED,\n
dtype: 'bool'\n});\n\nexport const greaterEqualConfig: KernelConfig = {\n kernelName: GreaterEqual,\n
backendName: 'webgl',\n kernelFunc: greaterEqual as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { IFFT, IFFTInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from './backend_webgl';\n\nimport { fftImpl } from './FFT_impl';\n\nexport function
ifft(args: { inputs: IFFTInputs, backend: MathBackendWebGL }):\n  TensorInfo {\n const { inputs, backend } =
args;\n const { input } = inputs;\n\n return fftImpl(input, true /* inverse */, backend);\n }\n\n\nexport const ifftConfig:
KernelConfig = {\n kernelName: IFFT,\n backendName: 'webgl',\n kernelFunc: ifft\n};\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { IsFinite, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from
 './kernel_utils/kernel_funcs_utils';\n\nconst IS_FINITE = `return float(!isnan(x) && !isinf(x));`\n\n\nexport const
isFinite = unaryKernelFunc({opSnippet: IS_FINITE, dtype: 'bool'});\n\nexport const isFiniteConfig: KernelConfig
= {\n kernelName: IsFinite,\n backendName: 'webgl',\n kernelFunc: isFinite\n};\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for

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the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {IsInf, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n'./kernel_utils/kernel_funcs_utils';\n\nconst IS_INF = `return float(isinf(x));`\n\nexport const isInf =\n  unaryKernelFunc({opSnippet: IS_INF, dtype: 'bool'});\n\nexport const isInfConfig: KernelConfig = {\n  kernelName: IsInf,\n  backendName: 'webgl',\n  kernelFunc: isInf,\n};\n\n"/**\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n
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```
=====\n\n*\n\nimport {IsNan, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n'./kernel_utils/kernel_funcs_utils';\n\nconst IS_NAN = `return float(isnan(x));`\n\nexport const isNaN =\n  unaryKernelFunc({opSnippet: IS_NAN, dtype: 'bool'});\n\nexport const isNaNConfig: KernelConfig = {\n  kernelName: IsNan,\n  backendName: 'webgl',\n  kernelFunc: isNaN,\n};\n\n"/**\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n
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```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, LessEqual} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc}\nfrom './kernel_utils/kernel_funcs_utils';\n\nexport const LESS_EQUAL = `return float(a <= b);`\n\nexport const\n  LESS_EQUAL_PACKED = `\n  return vec4(lessThanEqual(a, b));`\n\nexport const lessEqual =\n  binaryKernelFunc(\n    {opSnippet: LESS_EQUAL, packedOpSnippet: LESS_EQUAL_PACKED, dtype:\n    'bool'});\n\nexport const lessEqualConfig: KernelConfig = {\n  kernelName: LessEqual,\n  backendName: 'webgl',\n  kernelFunc: lessEqual as {\n    } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n
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```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, LinSpace, LinSpaceAttrs, TensorInfo}\nfrom '@tensorflow/tfjs-\ncore';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {linSpaceImplCPU} from\n'./kernel_utils/shared';\n\nexport function linSpace(\n  args: {backend: MathBackendWebGL, attrs:\n  LinSpaceAttrs}): TensorInfo {\n  const {backend, attrs} = args;\n  const {start, stop, num} = attrs;\n\n  // TODO:\n  Use CPU implementation due to the precision problem in Safari.\n  const outVals = linSpaceImplCPU(start, stop,\n  num);\n  return backend.makeTensorInfo([outVals.length], 'float32', outVals);\n}\n\nexport const linSpaceConfig:\n  KernelConfig = {\n  kernelName: LinSpace,\n  backendName: 'webgl',\n  kernelFunc: linSpace as {\n    } as\n  KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
```


License.\n * You may obtain a copy of the License at\n * <http://www.apache.org/licenses/LICENSE-2.0>\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNProgram implements GPGPUProgram {\n\n  variableNames = ['x'];\n  outputShape: number[] = [];\n  userCode: string;\n\n  constructor(\n    xShape: number[], radius: number, bias: number, alpha: number,\n    beta: number) {\n    const rad = radius;\n    const maxD = xShape[3] - 1;\n    this.outputShape = xShape;\n\n    // optimize pow(bias + alpha * sum, -beta)\n    // src: https://github.com/tensorflow/tensorflow/.\n    // blob/26033a1644a9c4a5f5e3170ab2e864b6a4ccd4ca/.\n    // tensorflow/core/kernels/mkl_lrn_op.cc#L320\n    let powOperator;\n    const basis = `float(${bias}) + float(${alpha}) * sum`;\n    if (beta === 0.5) {\n      powOperator = `inversesqrt(${basis})`;\n    } else if (beta === 1.0) {\n      powOperator = `1.0/(${basis})`;\n    } else {\n      powOperator = `exp(log(${basis}) * float(-${beta}))`;\n    }\n\n    this.userCode = `\n      void main() {\n        ivec4 coords = getOutputCoords();\n        int b = coords[0];\n        int r = coords[1];\n        int c = coords[2];\n        int d = coords[3];\n        float x = getX(b, r, c, d);\n\n        float sum = 0.0;\n        for (int j = -${rad}; j <= ${rad}; j++) {\n          int idx = d + j;\n          if (idx >= 0 && idx <= ${maxD}) {\n            float z = getX(b, r, c, idx);\n            sum += z * z;\n          }\n        }\n        float val = x * ${powOperator};\n        setOutput(val);\n      }\n    `;\n  }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class LRNPackedProgram implements GPGPUProgram {\n\n  variableNames = ['x'];\n  outputShape: number[] = [];\n  userCode: string;\n  packedInputs = true;\n  packedOutput = true;\n\n  constructor(\n    xShape: number[], radius: number, bias: number, alpha: number,\n    beta: number) {\n    const rad = radius;\n    const maxD = xShape[3] - 1;\n    this.outputShape = xShape;\n\n    // optimize pow(bias + alpha * sum, -beta)\n    // src: https://github.com/tensorflow/tensorflow/.\n    // blob/26033a1644a9c4a5f5e3170ab2e864b6a4ccd4ca/.\n    // tensorflow/core/kernels/mkl_lrn_op.cc#L320\n    let powOperator;\n    const basis = `float(${bias}) + float(${alpha}) * sum`;\n    if (beta === 0.5) {\n      powOperator = `inversesqrt(${basis})`;\n    } else if (beta === 1.0) {\n      powOperator = `1.0/(${basis})`;\n    } else {\n      powOperator = `exp(log(${basis}) * float(-${beta}))`;\n    }\n\n    this.userCode = `\n      void main() {\n        ivec4 coords = getOutputCoords();\n        int b = coords.x;\n        int r = coords.y;\n        int c = coords.z;\n        int d = coords.w;\n\n        bool hasNextCol = d < ${this.outputShape[3]};\n        bool hasNextRow = c < ${this.outputShape[2]};\n        vec4 sum = vec4(0.);\n        vec4 xFragAtOutputCoords = getX(b, r, c, d);\n        vec4 xAtOutputCoords = vec4(\n          getChannel(xFragAtOutputCoords, vec2(c, d)),\n          hasNextCol ?\n            getChannel(xFragAtOutputCoords, vec2(c, d + 1)) : 0.0,\n          hasNextRow ?\n            getChannel(xFragAtOutputCoords, vec2(c + 1, d)) : 0.0,\n            (hasNextRow && hasNextCol) ?\n            getChannel(xFragAtOutputCoords, vec2(c + 1, d + 1)) : 0.0\n        );\n\n        int firstChannel = d - ${rad};\n        vec2 cache = vec2(0.);\n        if (firstChannel >= 0) {\n          vec4 firstChannelFrag = getX(b, r, c, firstChannel);\n          cache.x = getChannel(firstChannelFrag, vec2(c, firstChannel));\n          if (hasNextRow) {\n            cache.y = getChannel(firstChannelFrag, vec2(c + 1, firstChannel));\n          }\n        }\n\n        ivec2 depth = ivec2(d, d + 1);\n        for (int j = -${rad}; j <= ${rad}; j++) {\n          ivec2 idx = depth + j;\n          bvec2 aboveLowerBound = greaterThanEqual(idx, ivec2(0));\n          bvec2 belowUpperBound = lessThanEqual(idx, ivec2(${maxD}));\n          bool depthInRange = aboveLowerBound.x && belowUpperBound.x;\n          bool depthPlusOneInRange =\n\n=====\n
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aboveLowerBound.y && belowUpperBound.y;\n\n    if(depthInRange || depthPlusOneInRange){\n        vec4 z
= vec4(0.);\n        vec4 xFragAtCurrentDepth;\n        z.xz = cache.xy;\n        if(depthPlusOneInRange &&
hasNextCol){\n            xFragAtCurrentDepth = idx.y != d ?\n                getX(b, r, c, idx.y) :
xFragAtOutputCoords;\n            z.y = getChannel(xFragAtCurrentDepth, vec2(c, idx.y));\n
if(hasNextRow){\n                z.w = getChannel(xFragAtCurrentDepth, vec2(c + 1, idx.y));\n            }\n        }\n        cache.xy = z.yw;\n        sum += z * z;\n    }\n    }\n    vec4 result = xAtOutputCoords *
${powOperator};\n    setOutput(result);\n    }\n    `;\n    }\n}\n\n",/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {env, KernelConfig, KernelFunc, LRN, LRNAttrs, LRNInputs, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {LRNProgram} from
 '../lrn_gpu';\n\nimport {LRNPackedProgram} from '../lrn_packed_gpu';\n\nexport const lrn =\n (args: {inputs:
LRNInputs, backend: MathBackendWebGL, attrs: LRNAttrs}):\n    TensorInfo => {\n        const {inputs,
backend, attrs} = args;\n        const {x} = inputs;\n        const {depthRadius, bias, alpha, beta} = attrs;\n\n
const program = env().getBool('WEBGL_PACK_NORMALIZATION') ?\n            new
LRNPackedProgram(x.shape, depthRadius, bias, alpha, beta) :\n            new LRNProgram(x.shape, depthRadius,
bias, alpha, beta);\n        return backend.runWebGLProgram(program, [x], x.dtype);\n    };\n\n// tslint:disable-
next-line: variable-name\n\nexport const LRNConfig: KernelConfig = {\n    kernelName: LRN,\n    backendName:
'webgl',\n    kernelFunc: lrn as { } as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {GPGPUProgram} from '../gpgpu_math';\n\nexport class LRNGradProgram implements
GPGPUProgram {\n    variableNames = ['inputImage', 'outputImage', 'dy'];\n    outputShape: number[] = [];\n
    userCode: string;\n    depthRadius: number;\n    bias: number;\n    alpha: number;\n    beta: number;\n    depth: number;\n\n
constructor(\n    inputShape: number[], depthRadius: number, bias: number, alpha: number,\n    beta: number) {\n
        this.outputShape = inputShape;\n        this.depth = inputShape[3];\n        this.depthRadius = depthRadius;\n
        this.bias = bias;\n        this.alpha = alpha;\n        this.beta = beta;\n        this.userCode = `\n
void main() {\n    ivec4 coords =
getOutputCoords();\n    int b = coords[0];\n    int r = coords[1];\n    int c = coords[2];\n\n    float result =
0.0;\n    for (int d = 0; d < ${this.depth}; ++d) {\n        int depthBegin = int(max(0.0, float(d -
${depthRadius}));\n        int depthEnd = int(min(float(${this.depth}),\n            float(d + ${depthRadius} +
1)));\n\n        const int MIN_DEPTH_BEGIN = 0;\n        const int MAX_DEPTH_END = ${this.depth};\n\n
float norm = 0.0;\n        for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k) {\n            if (k <
depthBegin){\n                continue;\n            }\n            else if (k >= depthBegin && k < depthEnd) {\n                norm
+= getInputImage(b, r, c, k) * getInputImage(b, r, c, k);\n            }\n            else {\n                break;\n            }\n
        }\n        norm = float(${alpha}) * norm + float(${bias});\n\n        for(int k = MIN_DEPTH_BEGIN; k <
MAX_DEPTH_END; ++k){\n            if (k < depthBegin){\n                continue;\n            }\n            else if (k >=
depthBegin && k < depthEnd){\n                float dyi = -2.0 * float(${alpha})\n                    * float(${beta})\n                *\n                getInputImage(b ,r ,c, k) * getOutputImage(b, r, c, d)\n                    / norm;\n                if (k == d) {\n                    dyi +=

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pow(norm, -1.0 * ${beta});\n          }\n          if (k == coords[3]) {\n          dyi *= getDy(b, r, c, d);\n          result += dyi;\n          }\n          }\n          else {\n          break;\n          }\n          }\n          }\n          }\n          `;\n          }\n          }\n          }", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, LRNGrad, LRNGradAttrs, LRNGradInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { LRNGradProgram } from '../lrn_grad_gpu';\n\nexport const lrnGrad = (args: {\n  inputs: LRNGradInputs,\n  backend: MathBackendWebGL,\n  attrs: LRNGradAttrs\n}): TensorInfo => {\n  const {inputs, backend, attrs} = args;\n  const {x, y, dy} = inputs;\n  const {depthRadius, bias, alpha, beta} = attrs;\n\n  const program = new LRNGradProgram(x.shape, depthRadius, bias, alpha, beta);\n  return backend.runWebGLProgram(program, [x, y, dy], x.dtype);\n};\n\n// tslint:disable-next-line: variable-name\nexport const LRNGradConfig: KernelConfig = {\n  kernelName: LRNGrad,\n  backendName: 'webgl',\n  kernelFunc: lrnGrad as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util, KernelConfig, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { maxImplCPU } from '../kernel_utils/shared';\nimport { maxImpl } from './Max_impl';\nimport { transposeImpl, transposeImplCPU } from './Transpose_impl';\n\nexport function max(\n  args: {\n    inputs: MaxInputs,\n    backend: MathBackendWebGL,\n    attrs: MaxAttrs\n  }): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {reductionIndices, keepDims} = attrs;\n\n  const xRank = x.shape.length;\n  const origAxes = util.parseAxisParam(reductionIndices, x.shape);\n  let axes = origAxes;\n  const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n  const maxInputIsTransposed = permutedAxes !== null;\n  const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([x]);\n  let maxInput = x;\n  if (maxInputIsTransposed) {\n    if (shouldExecuteOnCPU) {\n      const xTexData = backend.texData.get(maxInput.dataId);\n      const values = xTexData.values as TypedArray;\n      const newShape: number[] = new Array(xRank);\n      for (let i = 0; i < newShape.length; i++) {\n        newShape[i] = x.shape[permutedAxes[i]];\n      }\n      const maxInputValues =\n        transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n      maxInput = backend.makeTensorInfo(newShape, x.dtype);\n      const maxInputData = backend.texData.get(maxInput.dataId);\n      maxInputData.values = maxInputValues;\n    } else {\n      maxInput = transposeImpl(x, permutedAxes, backend);\n    }\n  }\n  axes = backend_util.getInnerMostAxes(axes.length, xRank);\n  backend_util.assertAxesAreInnerMostDims('max', axes, xRank);\n  const [maxOutShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(maxInput.shape, axes);\n  let outShape = maxOutShape;\n  if (keepDims) {\n    // rather than reshape at the end, set the target shape here.\n    outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes);\n  }\n  let out;\n  if (shouldExecuteOnCPU) {\n    const xTexData = backend.texData.get(maxInput.dataId);\n    const values = xTexData.values as TypedArray;\n    const outValues =\n      maxImplCPU(values, util.sizeFromShape(reduceShape), outShape, x.dtype);\n    out =

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backend.makeTensorInfo(outShape, x.dtype);\n  const outData = backend.texData.get(out.dataId);\n  outData.values = outValues;\n } else {\n  out = maxImpl(maxInput, reduceShape, outShape, backend);\n }\n\n if\n (maxInputIsTransposed) {\n  backend.disposeIntermediateTensorInfo(maxInput);\n }\n\n return out;\n }\n\nexport\n const maxConfig: KernelConfig = {\n  kernelName: Max,\n  backendName: 'webgl',\n  kernelFunc: max as {} as\n  KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util}\n from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport\n {Pool2DProgram} from './pool_gpu';\nimport {assertNotComplex} from './webgl_util';\nimport {identity} from\n './Identity';\n\nexport function maxPool(args: {\n  inputs: MaxPoolInputs,\n  backend: MathBackendWebGL,\n  attrs: MaxPoolAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  assertNotComplex(x, 'maxPool');\n  const {filterSize, strides, pad, dimRoundingMode} = attrs;\n  const dilations =\n  1;\n\n  util.assert(\n    backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n    () => 'Error in\n maxPool: Either strides or dilations must be 1. ' +\n    `Got strides ${strides} and dilations '${dilations}'`);\n\n  const convInfo = backend_util.computePool2DInfo(\n    x.shape as [number, number, number, number], filterSize,\n    strides,\n    dilations, pad, dimRoundingMode);\n  if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1\n    &&\n    util.arraysEqual(convInfo.inShape, convInfo.outShape)) {\n    return identity({inputs: {x}, backend});\n  }\n  const maxPoolProgram = new Pool2DProgram(convInfo, 'max', false);\n  return\n  backend.runWebGLProgram(maxPoolProgram, [x], x.dtype);\n }\n\nexport const maxPoolConfig: KernelConfig =\n {\n  kernelName: MaxPool,\n  backendName: 'webgl',\n  kernelFunc: maxPool as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

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*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs,\n TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport\n {Pool3DProgram} from './pool_gpu';\n\nexport function maxPool3d(args: {\n  inputs: MaxPool3DInputs,\n  backend: MathBackendWebGL,\n  attrs: MaxPool3DAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} =\n  args;\n  const {x} = inputs;\n  const {filterSize, strides, pad, dataFormat, dimRoundingMode} = attrs;\n  const\n  dilations: [number, number, number] = [1, 1, 1];\n\n  const convInfo = backend_util.computePool3DInfo(\n    x.shape as [number, number, number, number, number], filterSize, strides,\n    dilations, pad, dimRoundingMode,\n    dataFormat);\n  const maxPoolProgram = new Pool3DProgram(convInfo, 'max', false);\n  return\n  backend.runWebGLProgram(maxPoolProgram, [x], x.dtype);\n }\n\nexport const maxPool3DConfig: KernelConfig\n = {\n  kernelName: MaxPool3D,\n  backendName: 'webgl',\n  kernelFunc: maxPool3d as {} as\n  KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

```

implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n './gpgpu_math';\n\nexport class MaxPool2DBackpropProgram implements GPGPUProgram {\n  variableNames =\n    ['dy', 'maxPos'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(convInfo:\n    backend_util.Conv2DInfo) {\n    this.outputShape = convInfo.inShape;\n    const strideHeight =\n      convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const dilationHeight =\n      convInfo.dilationHeight;\n    const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n    const\n      effectiveFilterWidth = convInfo.effectiveFilterWidth;\n    const padTop = effectiveFilterHeight - 1 -\n      convInfo.padInfo.top;\n    const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n    const lastIndex =\n      effectiveFilterHeight * effectiveFilterWidth - 1;\n    this.userCode = `\n      const ivec2 pads = ivec2(${padTop},\n        ${padLeft});\n      void main() {\n        ivec4 coords = getOutputCoords();\n        int b = coords[0];\n        int d =\n          coords[3];\n        ivec2 dyRCCorner = coords.yz - pads;\n        int dyRCorner = dyRCCorner.x;\n        int\n          dyCCorner = dyRCCorner.y;\n        // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n        // ? =\n        to be determined. := across all values in that axis.\n        float dotProd = 0.0;\n        for (int wR = 0; wR <\n          ${effectiveFilterHeight};\n          wR += ${dilationHeight}) {\n          float dyR = float(dyRCorner + wR) /\n            ${strideHeight}.0;\n          if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n            continue;\n          }\n          int idyR = int(dyR);\n          for (int wC = 0; wC < ${effectiveFilterWidth}; wC++) {\n            float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n            if (dyC < 0.0 || dyC >=\n              ${convInfo.outWidth}.0 ||\n                fract(dyC) > 0.0) {\n              continue;\n            }\n            int idyC =\n              int(dyC);\n            float dyValue = getDy(b, idyR, idyC, d);\n            int maxPosValue = ${lastIndex} -\n              int(getMaxPos(b, idyR, idyC, d));\n            // Get the current value, check it against the value from the\n            //\n            position matrix.\n            int curPosValue = wR * ${effectiveFilterWidth} + wC;\n            float mask =\n              float(maxPosValue == curPosValue ? 1.0 : 0.0);\n            dotProd += dyValue * mask;\n          }\n          setOutput(dotProd);\n        }\n      `;\n    }\n  }\n\n  export class MaxPool3DBackpropProgram implements\n    GPGPUProgram {\n    variableNames = ['dy', 'maxPos'];\n    outputShape: number[];\n    userCode: string;\n\n    constructor(convInfo: backend_util.Conv3DInfo) {\n      this.outputShape = convInfo.inShape;\n      const strideDepth =\n        convInfo.strideDepth;\n      const strideHeight = convInfo.strideHeight;\n      const strideWidth =\n        convInfo.strideWidth;\n      const dilationDepth = convInfo.dilationDepth;\n      const dilationHeight =\n        convInfo.dilationHeight;\n      const dilationWidth = convInfo.dilationWidth;\n      const effectiveFilterDepth =\n        convInfo.effectiveFilterDepth;\n      const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n      const\n        effectiveFilterWidth = convInfo.effectiveFilterWidth;\n      const padFront = effectiveFilterDepth - 1 -\n        convInfo.padInfo.front;\n      const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n      const padLeft =\n        effectiveFilterWidth - 1 - convInfo.padInfo.left;\n\n      const lastIndex =\n        effectiveFilterDepth * effectiveFilterHeight * effectiveFilterWidth - 1;\n      this.userCode = `\n        const ivec3 pads = ivec3(${padFront},\n          ${padTop}, ${padLeft});\n        void main() {\n          ivec5 coords = getOutputCoords();\n          int batch =\n            coords.x;\n          int ch = coords.u;\n          ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;\n          int\n            dyDCorner = dyCorner.x;\n          int dyRCorner = dyCorner.y;\n          int dyCCorner = dyCorner.z;\n          //\n          Convolve dy(?, ?, ?, ch) with pos mask(:, :, :, d) to get\n          // dx(xD, xR, xC, ch).\n          // ? = to be determined. :=\n          across all values in that axis.\n          float dotProd = 0.0;\n          for (int wD = 0; wD < ${effectiveFilterDepth};\n            wD += ${dilationDepth}) {\n            float dyD = float(dyDCorner + wD) / ${strideDepth}.0;\n            if (dyD <\n              0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD) > 0.0) {\n              continue;\n            }\n            int idyD =\n              int(dyD);\n            for (int wR = 0; wR < ${effectiveFilterHeight};\n              wR += ${dilationHeight}) {\n              float dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n              if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0\n                ||\n                  fract(dyR) > 0.0) {\n                continue;\n              }\n              int idyR = int(dyR);\n              for (int wC =\n                0; wC < ${effectiveFilterWidth};\n                wC += ${dilationWidth}) {\n                float dyC = float(dyCCorner +\n                  wC) / ${strideWidth}.0;\n                if (dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n                  fract(dyC) > 0.0)
```



```

maxPoolBackPropProgram, [dy, maxPoolPositions], x.dtype);\n
backend.disposeIntermediateTensorInfo(maxPoolPositions);\n return result;\n}\n\nexport const
maxPoolGradConfig: KernelConfig = {\n kernelName: MaxPoolGrad,\n backendName: 'webgl',\n kernelFunc:
maxPoolGrad as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { Pool2DProgram } from './pool_gpu';\n\nexport function maxPoolWithArgmaxImpl(\n
x: TensorInfo, includeBatchInIndex: boolean,\n convInfo: backend_util.Conv2DInfo,\n backend:
MathBackendWebGL): TensorInfo[] {\n let program = new Pool2DProgram(convInfo, 'max', false);\n const
poolOutput = backend.runWebGLProgram(program, [x], 'float32');\n\n program = new Pool2DProgram(convInfo,
'max', true, true, includeBatchInIndex);\n const indexOutput = backend.runWebGLProgram(program, [x],
'float32');\n return [poolOutput, indexOutput];\n}\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs } from
'@tensorflow/tfjs-core';\n\nimport { backend_util, KernelConfig, util } from '@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from './backend_webgl';\n\nimport { maxPoolWithArgmaxImpl } from
'./MaxPoolWithArgmax_impl';\n\nexport const maxPoolWithArgmaxConfig: KernelConfig = {\n kernelName:
MaxPoolWithArgmax,\n backendName: 'webgl',\n kernelFunc: ((inputs, attrs, backend) => {\n const {x} =
inputs as MaxPoolWithArgmaxInputs;\n const {filterSize, strides, pad, includeBatchInIndex} =\n attrs as { }
as MaxPoolWithArgmaxAttrs;\n const webglBackend = backend as MathBackendWebGL;\n\n util.assert(\n
x.shape.length === 4,\n () => `Error in maxPool: input must be rank 4 but got rank ${\n
x.shape.length}`);\n const dilations: [number, number] = [1, 1];\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in maxPool: Either strides or
dilations must be 1. ` +\n `Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =
backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize, strides,\n
dilations, pad);\n\n const [result, indexes] =\n maxPoolWithArgmaxImpl(x, includeBatchInIndex, convInfo,
webglBackend);\n return [result, indexes];\n });\n", "/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { reduce } from './kernel_utils/reduce';\n\nimport { reshape } from

```



```

const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return output;\n};\n\nexport const
mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'webgl',\n kernelFunc:
mirrorPadKernelFunc as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {KernelConfig, KernelFunc, Mod} from '@tensorflow/tfjs-core';\n\nimport
{CHECK_NAN_SNIPPET} from './binaryop_packed_gpu';\nimport {binaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst MOD = `if (b == 0.0) return NAN;\n return mod(a, b);`\n\nconst
MOD_PACKED = `\n vec4 result = mod(a, b);\n vec4 isNaN = vec4(equal(b, vec4(0.0)));`;\n ` +\n
CHECK_NAN_SNIPPET + `\n return result;\n`;\n\nexport const mod = binaryKernelFunc({\n opSnippet: MOD,\n
packedOpSnippet: MOD_PACKED,\n});\n\nexport const modConfig: KernelConfig = {\n kernelName: Mod,\n
backendName: 'webgl',\n kernelFunc: mod as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2017
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class MultinomialProgram implements GPGPUProgram {\n variableNames = ['probs'];\n outputShape: number[];\n
userCode: string;\n\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n\n
constructor(batchSize: number, numOutcomes: number, numSamples: number) {\n this.outputShape = [batchSize,
numSamples];\n\n this.userCode = `\n uniform float seed;\n\n void main() {\n ivec2 coords =
getOutputCoords();\n  int batch = coords[0];\n  float r = random(seed);\n  float cdf = 0.0;\n\n for
(int i = 0; i < ${numOutcomes - 1}; i++) {\n  cdf += getProbs(batch, i);\n\n if (r < cdf) {\n
setOutput(float(i));\n return;\n }\n }\n\n // If no other event happened, last event happened.\n
setOutput(float(${numOutcomes - 1}));\n }\n `;\n\n getCustomSetupFunc(seed: number) {\n return
(gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.seedLoc == null) {\n
this.seedLoc = gpgpu.getUniformLocation(webGLProgram, 'seed');\n }\n gpgpu.gl.uniform1f(this.seedLoc,
seed);\n }; }\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {RealDiv} from '@tensorflow/tfjs-core';\nimport {KernelConfig} from '@tensorflow/tfjs-
core';\nimport {binaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\n// Without the equality check div
produces 0.9999 for a = b, which when\n// floored can cause errors.\nconst DIV = `\nif (a == b) {\n return
1.0;\n};\nreturn a / b;`\n\n// We do the same as in ./binaryop_gpu, with vec4 and ivec4.\n// On Linux, the vectorized
implementation produces NaNs when a and b are 0.\nconst DIV_PACKED = `\n // vec4 one = vec4(equal(a, b));\n

```

```

// return one + (vec4(1.0) - one) * a / b;\n  vec4 result = a / b;\n  if(a.x == b.x) {\n    result.x = 1.;\n  }\n  if(a.y ==
b.y) {\n    result.y = 1.;\n  }\n  if(a.z == b.z) {\n    result.z = 1.;\n  }\n  if(a.w == b.w) {\n    result.w = 1.;\n  }\n\n
return result;\n`;\n\nexport const realDiv = binaryKernelFunc(\n  {opSnippet: DIV, packedOpSnippet:
DIV_PACKED, checkOutOfBounds: true});\n\nexport const realDivConfig: KernelConfig = {\n  kernelName:
RealDiv,\n  backendName: 'webgl',\n  kernelFunc: realDiv,\n};\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {exp} from
'./Exp';\nimport {max} from './Max';\nimport {realDiv} from './RealDiv';\nimport {reshape} from
'./Reshape';\nimport {sub} from './Sub';\nimport {sum} from './Sum';\n\nexport function softmax(args: {\n  inputs:
SoftmaxInputs,\n  backend: MathBackendWebGL,\n  attrs: SoftmaxAttrs\n}): TensorInfo {\n  const {inputs,
backend, attrs} = args;\n  const {logits} = inputs;\n  const {dim} = attrs;\n\n  const axes =
util.parseAxisParam([dim], logits.shape);\n\n  const maxLogit = max({\n    inputs: {x: logits},\n    backend,\n
attrs: {reductionIndices: axes, keepDims: false}\n  });\n\n  const expandedShape =
backend_util.expandShapeToKeepDim(maxLogit.shape, axes);\n\n  const maxLogitsReshaped =\n
reshape({inputs: {x: maxLogit}, backend, attrs: {shape: expandedShape}});\n  const a =\n    sub({inputs: {a: logits,
b: maxLogitsReshaped}, backend}) as TensorInfo;\n  const b = exp({inputs: {x: a}, backend}) as TensorInfo;\n
const sumExp =\n    sum({inputs: {x: b}, backend, attrs: {axis: axes, keepDims: false}});\n  const
sumExpReshaped =\n    reshape({inputs: {x: sumExp}, backend, attrs: {shape: expandedShape}});\n\n  const res
=\n    realDiv({inputs: {a: b, b: sumExpReshaped}, backend}) as TensorInfo;\n\n  backend.disposeIntermediateTensorInfo(maxLogit);\n
backend.disposeIntermediateTensorInfo(maxLogitsReshaped);\n  backend.disposeIntermediateTensorInfo(a);\n
backend.disposeIntermediateTensorInfo(b);\n  backend.disposeIntermediateTensorInfo(sumExp);\n
backend.disposeIntermediateTensorInfo(sumExpReshaped);\n\n  return res;\n};\n\nexport const softmaxConfig:
KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'webgl',\n  kernelFunc: softmax as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Multinomial, MultinomialAttrs, MultinomialInputs, TensorInfo} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{MultinomialProgram} from './multinomial_gpu';\n\nimport {softmax} from './Softmax';\n\nexport function
multinomial(args: {\n  inputs: MultinomialInputs,\n  backend: MathBackendWebGL,\n  attrs: MultinomialAttrs\n}):
TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {logits} = inputs;\n  const {numSamples, seed,
normalized} = attrs;\n\n  const probs = normalized ?\n    logits :\n    softmax(\n      {inputs: {logits}, backend,
attrs: {dim: logits.shape.length - 1}});\n  const batchSize = probs.shape[0];\n  const numOutcomes =
probs.shape[1];\n  const program = new MultinomialProgram(batchSize, numOutcomes, numSamples);\n  const
customSetup = program.getCustomSetupFunc(seed);\n\n  const res = backend.runWebGLProgram(program, [probs],

```


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```
=====  
*  
import { backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo, TypedArray } from '@tensorflow/tfjs-core';  
const nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;  
import { MathBackendWebGL } from '../backend_webgl';  
export function nonMaxSuppressionV5(args: { inputs: NonMaxSuppressionV5Inputs, backend: MathBackendWebGL, attrs: NonMaxSuppressionV5Attrs }): [TensorInfo, TensorInfo] {  
  backend_util.warn('tf.nonMaxSuppression() in webgl locks the UI thread. ' +  
    'Call tf.nonMaxSuppressionAsync() instead');  
  const { inputs, backend, attrs } = args;  
  const { boxes, scores } = inputs;  
  const { maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma } = attrs;  
  const boxesVals = backend.readSync(boxes.dataId) as TypedArray;  
  const scoresVals = backend.readSync(scores.dataId) as TypedArray;  
  const maxOutputSizeVal = maxOutputSize;  
  const iouThresholdVal = iouThreshold;  
  const scoreThresholdVal = scoreThreshold;  
  const softNmsSigmaVal = softNmsSigma;  
  const { selectedIndices, selectedScores } = nonMaxSuppressionV5Impl(  
    boxesVals, scoresVals, maxOutputSizeVal, iouThresholdVal, scoreThresholdVal, softNmsSigmaVal);  
  return [backend.makeTensorInfo([selectedIndices.length], 'int32', new Int32Array(selectedIndices)),  
    backend.makeTensorInfo([selectedScores.length], 'float32', new Float32Array(selectedScores))];  
}  
export const nonMaxSuppressionV5Config: KernelConfig = {  
  kernelName: NonMaxSuppressionV5, backendName: 'webgl',  
  kernelFunc: nonMaxSuppressionV5 as KernelFunc; }  
;"/>  
=====  
*  
import { GPGPUProgram } from '../gpgpu_math';  
export class OneHotProgram implements GPGPUProgram {  
  variableNames = ['indices'];  
  outputShape: number[];  
  userCode: string;  
  // Caching uniform location for speed.  
  seedLoc: WebGLUniformLocation;  
  constructor(numIndices: number, depth: number, onValue: number, offValue: number) {  
    this.outputShape = [numIndices, depth];  
    this.userCode = `void main() {  
  ivec2 coords = getOutputCoords();  
  int index = round(getIndices(coords.x));  
  setOutput(mix(float(${offValue}), float(${onValue}), float(index == coords.y)));  
}  
`;  
}  
;"/>  
=====  
*  
import { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs, TensorInfo, util } from '@tensorflow/tfjs-core';  
import { MathBackendWebGL } from '../backend_webgl';  
import { OneHotProgram } from '../onehot_gpu';  
import { reshape } from './Reshape';  
export const oneHot = (args: { inputs: OneHotInputs, backend: MathBackendWebGL, attrs: OneHotAttrs }): TensorInfo => {  
  const { inputs, backend, attrs } = args;  
  const { indices } = inputs;  
  const { depth, onValue, offValue } = attrs;  
  const indicesSize = util.sizeFromShape(indices.shape);  
  const program = new OneHotProgram(indicesSize, depth,
```

```

onValue, offValue);
const reshaped = reshape({inputs: {x: indices}, backend, attrs: {shape:
[indicesSize]}});
const result = backend.runWebGLProgram(program, [reshaped], indices.dtype);
backend.disposeIntermediateTensorInfo(reshaped);
const outShape = [...indices.shape, depth];
const out =
reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});
backend.disposeIntermediateTensorInfo(result);
return out;
}
export const oneHotConfig: KernelConfig =
{
kernelName: OneHot,
backendName: 'webgl',
kernelFunc: oneHot as { } as KernelFunc
};
/**
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 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version
 2.0 (the "License");
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  law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for
  the specific language governing permissions and
 * limitations under the License.
 */
=====
import {KernelConfig, KernelFunc, TensorInfo, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-
core';
import {MathBackendWebGL} from '../backend_webgl';
import {complex} from './Complex';
import {fill} from './Fill';
import {imag} from './Imag';
import {real} from './Real';
export function zerosLike(
args: {inputs: ZerosLikeInputs, backend: MathBackendWebGL}): TensorInfo {
const {inputs, backend} = args;
const {x} = inputs;
if (x.dtype === 'complex64') {
const realPart = real({inputs: {input: x}, backend});
const r = zerosLike({inputs: {x: realPart}, backend});
const imagPart = imag({inputs: {input: x}, backend});
const i = zerosLike({inputs: {x: imagPart}, backend});
const result = complex({inputs: {real: r, imag: i},
backend});
backend.disposeIntermediateTensorInfo(realPart);
backend.disposeIntermediateTensorInfo(r);
backend.disposeIntermediateTensorInfo(imagPart);
backend.disposeIntermediateTensorInfo(i);
return result;
} else {
return fill({
attrs: {
shape:
x.shape,
dtype: x.dtype,
value: x.dtype === 'string' ? " : 0\n",
backend
});
}
}
export const zerosLikeConfig: KernelConfig = {
kernelName: ZerosLike,
backendName: 'webgl',
kernelFunc:
zerosLike as { } as KernelFunc
};
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 * limitations under the License.
 */
=====
import {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs, TensorInfo} from '@tensorflow/tfjs-
core';
import {MathBackendWebGL} from '../backend_webgl';
import {complex} from './Complex';
import {fill} from './Fill';
import {imag} from './Imag';
import {real} from './Real';
import {zerosLike} from
 './ZerosLike';
export function onesLike(
args: {inputs: OnesLikeInputs, backend: MathBackendWebGL}):
TensorInfo {
const {inputs, backend} = args;
const {x} = inputs;
if (x.dtype === 'string') {
throw new
Error('onesLike is not supported under string dtype');
} else if (x.dtype === 'complex64') {
const realPart =
real({inputs: {input: x}, backend});
const r = onesLike({inputs: {x: realPart}, backend});
const imagPart =
imag({inputs: {input: x}, backend});
const i = zerosLike({inputs: {x: imagPart}, backend});
const result =
complex({inputs: {real: r, imag: i}, backend});
backend.disposeIntermediateTensorInfo(realPart);
backend.disposeIntermediateTensorInfo(r);
backend.disposeIntermediateTensorInfo(imagPart);
backend.disposeIntermediateTensorInfo(i);
return result;
} else {
// TODO(cais, smilkov): Add WebGL
shader for onesLike.
// https://github.com/tensorflow/tfjs/issues/1293
return fill({attrs: {shape: x.shape,
dtype: x.dtype, value: 1}, backend});
}
}
export const onesLikeConfig: KernelConfig = {
kernelName:
OnesLike,
backendName: 'webgl',
kernelFunc: onesLike as { } as KernelFunc
};
/**
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { concat } from './Concat';\nimport { expandDims } from './ExpandDims';\n\nexport function pack(\n  args: { inputs: PackInputs, backend: MathBackendWebGL, attrs: PackAttrs }):\n  TensorInfo {\n  const { inputs, backend, attrs } = args;\n  const { axis } = attrs;\n\n  if (inputs.length === 1) {\n    return expandDims(\n      { inputs: { input: inputs[0] }, backend, attrs: { dim: axis } });\n  }\n\n  const shape = inputs[0].shape;\n  const dtype = inputs[0].dtype;\n\n  inputs.forEach(t => {\n    util.assertShapesMatch(\n      shape, t.shape, \n      'All tensors passed to stack must have matching shapes');\n    util.assert(\n      dtype === t.dtype, \n      () => 'All tensors passed to stack must have matching dtypes');\n  });\n\n  const intermediateTensorInfos: TensorInfo[] = [];\n  const expandedTensors = inputs.map(t => {\n    const expandedT =\n      expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\n    intermediateTensorInfos.push(expandedT);\n    return expandedT;\n  });\n\n  const result = concat({ inputs: expandedTensors, backend, attrs: { axis } });\n\n  intermediateTensorInfos.forEach(\n    t => backend.disposeIntermediateTensorInfo(t);\n  );\n\n  return result;\n}\n\nexport const packConfig: KernelConfig = {\n  kernelName: Pack,\n  backendName: 'webgl',\n  kernelFunc: pack as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getCoordsDataType } from './shader_compiler';\n\nexport class PadProgram implements GPGPUProgram {\n  variableNames = ['x'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(\n    xShape: number[],\n    paddings: Array<[number, number]>,\n    constantValue: number) {\n    this.outputShape = paddings.map(\n      (p, i) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n    const rank = xShape.length;\n    const type = getCoordsDataType(rank);\n\n    const start = paddings.map(p => p[0]).join(',');\n    const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n    const unpackedCoords =\n      ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);\n\n    if (rank === 1) {\n      this.userCode = `\n      int start = ${start};\n      int end = ${end};\n\n      void main() {\n        int outC = getOutputCoords();\n        if (outC < start || outC >= end) {\n          setOutput(float(${constantValue}));\n        } else {\n          setOutput(getX(outC - start));\n        }\n      }\n      `;\n      return;\n    }\n\n    this.userCode = `\n    ${type} start = ${type}(${start});\n    ${type} end = ${type}(${end});\n\n    void main() {\n      ${type} outC = getOutputCoords();\n      if (any(lessThan(outC, start)) || any(greaterThanEqual(outC, end))) {\n        setOutput(float(${constantValue}));\n      } else {\n        ${type} coords = outC - start;\n        setOutput(getX(${unpackedCoords}));\n      }\n    }\n    `;\n  }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n


```
'webgl',\n kernelFunc: relu as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, Relu6 } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from './kernel_utils/kernel_funcs_utils';\nimport { CHECK_NAN_SNIPPET } from './unaryop_gpu';\n\nconst RELU6 = CHECK_NAN_SNIPPET + `\n\nreturn (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\nconst RELU6_PACKED = `\n\nvec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n\nbvec4 isNaN = isNan(x);\n\nresult.r = isNaN.r ? x.r : result.r;\nresult.g = isNaN.g ? x.g : result.g;\nresult.b = isNaN.b ? x.b : result.b;\nresult.a = isNaN.a ? x.a : result.a;\n\nreturn result;\n`;\n\nexport const relu6 =\n\nunaryKernelFunc({ opSnippet: RELU6, packedOpSnippet: RELU6_PACKED });\n\nexport const relu6Config: KernelConfig = {\n\nkernelName: Relu6,\n\nbackendName: 'webgl',\n\nkernelFunc: relu6 as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeBilinearProgram implements GPGPUProgram {\n\nvariableNames = ['A'];\n\noutputShape: number[] = [];\n\nuserCode: string;\n\nconstructor(\n\ninputShape: [number, number, number, number],\n\nnewHeight: number,\n\nnewWidth: number,\n\nalignCorners: boolean,\n\nhalfPixelCenters: boolean) {\n\nconst [batch, oldHeight, oldWidth, depth] = inputShape;\n\nthis.outputShape = [batch, newHeight, newWidth, depth];\n\nconst effectiveInSize: [number, number] = [\n\n(alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n\n(alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n\n];\n\nconst effectiveOutSize: [number, number] = [\n\n(alignCorners && newHeight > 1) ? newHeight - 1 : newHeight,\n\n(alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n\n];\n\nlet sourceFracIndexRC: string;\n\nif (halfPixelCenters) {\n\nsourceFracIndexRC = `(vec2(yRC) + vec2(0.5)) * effectiveInputOverOutputRatioRC` +\n\n` - vec2(0.5)`;\n\n} else {\n\nsourceFracIndexRC = `vec2(yRC) * effectiveInputOverOutputRatioRC`;\n\n}\n\nthis.userCode = `\n\nconst vec2 effectiveInputOverOutputRatioRC = vec2(\n\n${effectiveInSize[0] / effectiveOutSize[0]},\n\n${effectiveInSize[1] / effectiveOutSize[1]});\n\nconst vec2 inputShapeRC = vec2(${oldHeight}.0,\n\n${oldWidth}.0);\n\nvoid main() {\n\nivec4 coords = getOutputCoords();\n\nint b = coords[0];\n\nint d = coords[3];\n\nivec2 yRC = coords.yz;\n\n// Fractional source index.\n\nvec2 sourceFracIndexRC = ${sourceFracIndexRC};\n\n// Compute the four integer indices.\n\nivec2 sourceFloorRC = ivec2(max(sourceFracIndexRC, vec2(0.0)));\n\nivec2 sourceCeilRC = ivec2(\n\nmin(inputShapeRC - 1.0, ceil(sourceFracIndexRC)));\n\nfloat topLeft = getA(b, sourceFloorRC.x, sourceFloorRC.y, d);\n\nfloat bottomLeft = getA(b, sourceCeilRC.x, sourceFloorRC.y, d);\n\nfloat topRight = getA(b, sourceFloorRC.x, sourceCeilRC.y, d);\n\nfloat bottomRight = getA(b, sourceCeilRC.x, sourceCeilRC.y, d);\n\nvec2 fracRC = sourceFracIndexRC - vec2(sourceFloorRC);\n\nfloat top = topLeft + (topRight - topLeft) * fracRC.y;\n\nfloat bottom = bottomLeft + (bottomRight - bottomLeft) * fracRC.y;\n\nfloat newValue = top + (bottom - top) * fracRC.x;\n\nsetOutput(newValue);\n\n}\n\n`;\n\n}\n\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
```

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```
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearPackedProgram implements
GPGPUProgram {\n  variableNames = ['A'];\n  packedInputs = true;\n  packedOutput = true;\n  outputShape:
number[] = [];\n  userCode: string;\n\n  constructor(\n    inputShape: [number, number, number, number],
newHeight: number,\n    newWidth: number, alignCorners: boolean, halfPixelCenters: boolean) {\n    const [batch,
oldHeight, oldWidth, depth] = inputShape;\n    this.outputShape = [batch, newHeight, newWidth, depth];\n\n    const effectiveInSize: [number, number] = [\n      (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n      (alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n    ];\n\n    const effectiveOutSize: [number, number]
= [\n      (alignCorners && newHeight > 1) ? newHeight - 1 : newHeight,\n      (alignCorners && newWidth > 1) ?
newWidth - 1 : newWidth\n    ];\n\n    let sourceFracIndexRC: string;\n    if (halfPixelCenters) {\n      sourceFracIndexRC = `(vec3(yRC) + vec3(0.5)) * ` +\n        `effectiveInputOverOutputRatioRC - vec3(0.5)`;\n    }
else {\n      sourceFracIndexRC = `vec3(yRC) * effectiveInputOverOutputRatioRC`;\n    }\n\n    this.userCode = `\n      const vec3 effectiveInputOverOutputRatioRC = vec3(\n        ${effectiveInSize[0] / effectiveOutSize[0]},\n        ${effectiveInSize[1] / effectiveOutSize[1]},\n        ${effectiveInSize[1] / effectiveOutSize[1]});\n      const vec3
inputShapeRC = vec3(${oldHeight}.0, ${oldWidth}.0,\n        ${oldWidth}.0);\n\n      float
getAValue(int b, int r, int c, int d) {\n        return getChannel(getA(b, r, c, d), vec2(c, d));\n      }\n\n      void main()
{\n        ivec4 coords = getOutputCoords();\n        int b = coords[0];\n        int d = coords[3];\n        // Calculate
values for next column in yRC.z.\n        ivec3 yRC = coords.yzz + ivec3(0, 0, 1);\n        // Fractional source
index.\n        vec3 sourceFracIndexRC = ${sourceFracIndexRC};\n        // Compute the four integer indices.\n        ivec3 sourceFloorRC = ivec3(max(sourceFracIndexRC, vec3(0.0)));\n        ivec3 sourceCeilRC = ivec3(\n
min(inputShapeRC - 1.0, ceil(sourceFracIndexRC)));\n        // Should we calculate next column and row elements
in 2x2 packed cell.\n        bool hasNextCol = d < ${depth} - 1;\n        bool hasNextRow = coords.z < ${newWidth} -
1);\n        // In parallel, construct four corners for all four components in\n        // packed 2x2 cell.\n        vec4
topLeft = vec4(\n          getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),\n          hasNextCol ? getAValue(b,
sourceFloorRC.x, sourceFloorRC.y, d + 1)\n            : 0.0,\n          hasNextRow ? getAValue(b,
sourceFloorRC.x, sourceFloorRC.z, d)\n            : 0.0,\n          (hasNextRow && hasNextCol) ?\n
getAValue(b, sourceFloorRC.x, sourceFloorRC.z, d + 1) : 0.0);\n        vec4 bottomLeft = vec4(\n
getAValue(b, sourceCeilRC.x, sourceFloorRC.y, d),\n          hasNextCol ? getAValue(b, sourceCeilRC.x,
sourceFloorRC.y, d + 1)\n            : 0.0,\n          hasNextRow ? getAValue(b, sourceCeilRC.x, sourceFloorRC.z,
d)\n            : 0.0,\n          (hasNextRow && hasNextCol) ?\n
getAValue(b, sourceCeilRC.x,
sourceFloorRC.z, d + 1) : 0.0);\n        vec4 topRight = vec4(\n          getAValue(b, sourceFloorRC.x,
sourceCeilRC.y, d),\n          hasNextCol ? getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d + 1)\n            :
0.0,\n          hasNextRow ? getAValue(b, sourceFloorRC.x, sourceCeilRC.z, d)\n            : 0.0,\n
(hasNextRow && hasNextCol) ?\n
getAValue(b, sourceFloorRC.x, sourceCeilRC.z, d + 1) : 0.0);\n        vec4 bottomRight = vec4(\n
getAValue(b, sourceCeilRC.x, sourceCeilRC.y, d),\n          hasNextCol ?
getAValue(b, sourceCeilRC.x, sourceCeilRC.y, d + 1)\n            : 0.0,\n          hasNextRow ?
getAValue(b,
sourceCeilRC.x, sourceCeilRC.z, d)\n            : 0.0,\n          (hasNextRow && hasNextCol) ?\n
getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d + 1) : 0.0);\n\n        vec3 fracRC = sourceFracIndexRC -
vec3(sourceFloorRC);\n        vec4 top = mix(topLeft, topRight, fracRC.yzz);\n        vec4 bottom =
mix(bottomLeft, bottomRight, fracRC.yzz);\n        vec4 newValue = mix(top, bottom, fracRC.x);\n\n        setOutput(newValue);\n      }\n    `;\n  }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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```
=====\n*\n\nimport {env, KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ResizeBilinearProgram} from '../resize_bilinear_gpu';\nimport {ResizeBilinearPackedProgram} from '../resize_bilinear_packed_gpu';\n\nexport function resizeBilinear(args: {\n  inputs: ResizeBilinearInputs,\n  backend: MathBackendWebGL,\n  attrs: ResizeBilinearAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {images} = inputs;\n  const {alignCorners, halfPixelCenters, size} = attrs;\n  const [newHeight, newWidth] = size;\n  const program = env().getBool('WEBGL_PACK_IMAGE_OPERATIONS') ?\n    new ResizeBilinearPackedProgram(\n      images.shape as [number, number, number, number], newHeight,\n      newWidth,\n      alignCorners, halfPixelCenters) : \n    new ResizeBilinearProgram(\n      images.shape as [number, number, number, number], newHeight, newWidth,\n      alignCorners, halfPixelCenters);\n  return backend.runWebGLProgram(program, [images], 'float32');\n}\n\nexport const resizeBilinearConfig: KernelConfig = {\n  kernelName: ResizeBilinear,\n  backendName: 'webgl',\n  kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
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```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeBilinearBackpropProgram implements GPGPUProgram {\n  variableNames = ['dy'];\n  outputShape: number[] = [];\n  userCode: string;\n  constructor(\n    dyShape: [number, number, number, number],\n    inputShape: [number, number, number, number],\n    alignCorners: boolean) {\n    this.outputShape = inputShape;\n    const [, xHeight, xWidth, ] = inputShape;\n    const [, yHeight, yWidth] = dyShape;\n\n    // In the backwards pass, we want to find the pixels that were generated for\n    // each pixel in the input image the forward pass and add the corresponding\n    // coefficient from dy to the gradient (with some interpolation).\n\n    const effectiveXSize: [number, number] = [\n      (alignCorners && yHeight > 1) ? xHeight - 1 : xHeight,\n      (alignCorners && yWidth > 1) ? xWidth - 1 : xWidth\n    ];\n\n    const effectiveYSize: [number, number] = [\n      (alignCorners && yHeight > 1) ? yHeight - 1 : yHeight,\n      (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n    ];\n\n    const heightScale = effectiveXSize[0] / effectiveYSize[0];\n    const widthScale = effectiveXSize[1] / effectiveYSize[1];\n\n    const invHeightScale = 1 / heightScale;\n    const invWidthScale = 1 / widthScale;\n\n    // This defines the size of the window of values around a particular\n    // index in dy that we want to search for contributions to dx.\n    const winHeight = (Math.ceil(invHeightScale) * 2) + 2;\n    const winWidth = (Math.ceil(invWidthScale) * 2) + 2;\n\n    this.userCode = `\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int b = coords[0];\n      int d = coords[3];\n      int r = coords[1];\n      int c = coords[2];\n\n      float accumulator = 0.0;\n\n      const float heightScale = float(${heightScale});\n      const float widthScale = float(${widthScale});\n\n      const float invHeightScale = float(${invHeightScale});\n      const float invWidthScale = float(${invWidthScale});\n\n      const int winHeight = int(${winHeight});\n      const int winWidth = int(${winWidth});\n\n      // Compute bounds for where in dy we will look\n      float startRLerp = floor(float(r) * invHeightScale);\n      int startDyR = int(startRLerp - float(winHeight / 2));\n      float startCLerp = floor(float(c) * invWidthScale);\n      int startDyC = int(startCLerp - float(winWidth / 2));\n\n      // Loop over dy\n      for (int dyROffset = 0; dyROffset < winHeight; dyROffset++) {\n        int dyR = dyROffset + startDyR;\n\n        // Guard against the window exceeding the bounds of dy\n        if (dyR < 0 || dyR >= ${yHeight}) {\n          continue;\n        }\n\n        for (int dyCOffset = 0; dyCOffset < winWidth; dyCOffset++)\n
```



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vec2(0.5)) * effectiveInputOverOutputRatioRC` +\n      `, vec2(0.0));\n  } else {\n    sourceFracIndexRC =
`vec2(yRC) * effectiveInputOverOutputRatioRC`;\n  }\n  this.userCode = `\n    const vec2
effectiveInputOverOutputRatioRC = vec2(\n      ${effectiveInSize[0] / effectiveOutSize[0]},\n
${effectiveInSize[1] / effectiveOutSize[1]});\n    const vec2 inputShapeRC = vec2(${oldHeight}.0,
${oldWidth}.0);\n\n    void main() {\n      ivec4 coords = getOutputCoords();\n      int b = coords[0];\n      int d
= coords[3];\n      ivec2 yRC = coords.yz;\n\n      // Fractional source index.\n      vec2 sourceFracIndexRC =
${sourceFracIndexRC};\n\n      // Compute the coordinators of nearest neighbor point.\n      ivec2
sourceNearestRC = ivec2(\n        min(inputShapeRC - 1.0, floor(sourceFracIndexRC + ${roundBase})));
\n      float newValue = getA(b, sourceNearestRC.x, sourceNearestRC.y, d);\n\n      setOutput(newValue);\n    }\n  `;\n
}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from
'./backend_webgl';\nimport { ResizeNearestNeighborProgram } from './resize_nearest_neighbor_gpu';\n\nexport
function resizeNearestNeighbor(args: {\n  inputs: ResizeNearestNeighborInputs,\n  backend:
MathBackendWebGL,\n  attrs: ResizeNearestNeighborAttrs\n}): TensorInfo {\n  const { inputs, backend, attrs } =
args;\n  const { images } = inputs;\n  const { alignCorners, halfPixelCenters, size } = attrs;\n\n  const [newHeight,
newWidth] = size;\n\n  const program = new ResizeNearestNeighborProgram(\n    images.shape as [number,
number, number, number], newHeight, newWidth,\n    alignCorners, halfPixelCenters);\n  return
backend.runWebGLProgram(program, [images], images.dtype);\n}\n\nexport const resizeNearestNeighborConfig:
KernelConfig = {\n  kernelName: ResizeNearestNeighbor,\n  backendName: 'webgl',\n  kernelFunc:
resizeNearestNeighbor as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeNearestNeighborBackpropProgram
implements GPGPUProgram {\n  variableNames = ['dy'];\n  outputShape: number[] = [];\n  userCode: string;\n\n  constructor(\n    dyShape: [number, number, number, number],\n    inputShape: [number, number, number,
number], alignCorners: boolean) {\n    this.outputShape = inputShape;\n    const [ xHeight, xWidth, ] =
inputShape;\n    const [ yHeight, yWidth ] = dyShape;\n\n    // In the backwards pass, we want to find the pixels that
were generated for\n    // each pixel in the input image the forward pass and add the corresponding\n    // coefficient
from dy to the gradient (with some interpolation).\n\n    const effectiveXSize: [number, number] = [\n
    (alignCorners && yHeight > 1) ? xHeight - 1 : xHeight,\n    (alignCorners && yWidth > 1) ? xWidth - 1 :
xWidth\n  ];\n\n    const effectiveYSize: [number, number] = [\n    (alignCorners && yHeight > 1) ? yHeight - 1 :
yHeight,\n    (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n  ];\n\n    const heightScale =
effectiveXSize[0] / effectiveYSize[0];\n    const widthScale = effectiveXSize[1] / effectiveYSize[1];\n\n    const
invHeightScale = 1 / heightScale;\n    const invWidthScale = 1 / widthScale;\n\n    // This defines the size of the
window of values around a particular\n    // index in dy that we want to search for contributions to dx.\n    const
winHeight = (Math.ceil(invHeightScale) * 2) + 2;\n    const winWidth = (Math.ceil(invWidthScale) * 2) + 2;\n\n

```

```

this.userCode = `
    void main() {
        ivec4 coords = getOutputCoords();
        int b = coords[0];
        int d =
        coords[3];
        int r = coords[1];
        int c = coords[2];
        float accumulator = 0.0;
        const float
        heightScale = float(${heightScale});
        const float widthScale = float(${widthScale});
        const float
        invHeightScale = float(${invHeightScale});
        const float invWidthScale = float(${invWidthScale});
        const int winHeight = int(${winHeight});
        const int winWidth = int(${winWidth});
        // Compute bounds
        for where in dy we will look
        float startRLerp = floor(float(r) * invHeightScale);
        int startDyR =
        int(floor(startRLerp - float(winHeight / 2)));
        float startCLerp = floor(float(c) * invWidthScale);
        int
        startDyC = int(floor(startCLerp - float(winWidth / 2)));
        // Loop over dy
        for (int dyROffset = 0;
        dyROffset < winHeight; dyROffset++) {
            int dyR = dyROffset + startDyR;
            // Guard against the
            window exceeding the bounds of dy
            if (dyR < 0 || dyR >= ${yHeight}) {
                continue;
            }
            for (int dyCOffset = 0; dyCOffset < winWidth; dyCOffset++) {
                int dyC = dyCOffset + startDyC;
                // Guard against the window exceeding the bounds of dy
                if (dyC < 0 || dyC >= ${yWidth}) {
                    continue;
                }
                float sourceFracRow =
                float(${effectiveXSize[0]}) *
                (float(dyR) / float(${effectiveYSize[0]}));
                float sourceFracCol =
                float(${effectiveXSize[1]})
                *
                (float(dyC) / float(${effectiveYSize[1]}));
                int sourceNearestRow = int(min(
                float(int(${xHeight}) - 1),
                ${alignCorners} ? float(round(sourceFracRow)) :
                float(floor(sourceFracRow)));
                int sourceNearestCol = int(min(
                float(int(${xWidth}) - 1),
                ${alignCorners} ? float(round(sourceFracCol)) :
                float(floor(sourceFracCol)));
                if (r == sourceNearestRow && c == sourceNearestCol) {
                    accumulator += getDy(b, dyR, dyC, d);
                }
            }
        }
        // End loop over dy
        setOutput(accumulator);
    }
`;
}

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=====
*/
import {KernelConfig, KernelFunc, ResizeNearestNeighborGrad, ResizeNearestNeighborGradAttrs,
ResizeNearestNeighborGradInputs, TensorInfo} from '@tensorflow/tfjs-core';
import {MathBackendWebGL}
from './backend_webgl';
import {ResizeNearestNeighborBackpropProgram} from
'./resize_nearest_neighbor_backprop_gpu';
export function resizeNearestNeighborGrad(args: {
inputs:
ResizeNearestNeighborGradInputs,
backend: MathBackendWebGL,
attrs:
ResizeNearestNeighborGradAttrs}): TensorInfo {
const {inputs, backend, attrs} = args;
const {images, dy} =
inputs;
const {alignCorners} = attrs;
const program = new ResizeNearestNeighborBackpropProgram(
dy.shape as [number, number, number, number],
images.shape as [number, number, number, number],
alignCorners);
return backend.runWebGLProgram(program, [dy], dy.dtype);
}
export const
resizeNearestNeighborGradConfig: KernelConfig = {
kernelName: ResizeNearestNeighborGrad,
backendName: 'webgl',
kernelFunc: resizeNearestNeighborGrad as {} as KernelFunc
};
}

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=====
*/
import {GPGPUProgram} from './gpgpu_math';
import {getCoordsDataType} from
'./shader_compiler';
export class ReverseProgram implements GPGPUProgram {
variableNames = ['x'];
outputShape: number[];
userCode: string;
constructor(xShape: number[], axis: number[]) {
const rank =

```

```
xShape.length;\n if (rank > 4) {\n   throw new Error(\n     `WebGL backend: Reverse of rank-${rank} tensor\n     is not yet supported`);\n }\n this.outputShape = xShape;\n\n if (rank === 1) {\n   this.userCode = `\n\n void main() {\n   int coord = getOutputCoords();\n   setOutput(getX(${xShape[0]} - coord - 1));\n }\n`;\n   return;\n }\n const getInCoord = (i: number) => {\n   if (axis.indexOf(i) !== -1 && xShape[i] !== 1)\n   {\n     return `${xShape[i]} - coords[${i]} - 1`;\n   }\n   return `coords[${i}]`;\n };\n const inCoords =\n xShape.map( (_, i) => getInCoord(i)).join(',');\n const type = getCoordsDataType(rank);\n\n this.userCode = `\n\n void main() {\n   ${type} coords = getOutputCoords();\n   setOutput(getX(${inCoords}));\n }\n`;\n\n }\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *

```

```
=====\n\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport\n {getCoordsDataType} from './shader_compiler';\n\nexport class ReversePackedProgram implements\n GPGPUProgram {\n  variableNames = ['x'];\n  outputShape: number[];\n  userCode: string;\n  packedInputs =\n true;\n  packedOutput = true;\n\n  constructor(xShape: number[], axis: number[]) {\n    const rank =\n xShape.length;\n    if (rank > 4) {\n      throw new Error(\n        `WebGL backend: Reverse of rank-${rank} tensor\n        is not yet supported`);\n    }\n    this.outputShape = xShape;\n    const channels = getChannels('rc', rank);\n    const\n nextColumn =\n   `${channels[rank - 1]} + 1 < ${this.outputShape[rank - 1]}`;\n    const nextRow =\n   `${channels[rank - 2]} + 1 < ${this.outputShape[rank - 2]}`;\n    const type = getCoordsDataType(rank);\n    if (rank\n === 1) {\n      this.userCode = `\n\n void main() {\n   int rc = getOutputCoords();\n   vec4 result =\n vec4(0.);\n   result.r = getChannel(getX(${xShape[0]} - rc - 1),\n   ${xShape[0]} - rc - 1);\n\n if(${nextColumn}){\n   result.g = getChannel(getX(${xShape[0]} - (rc + 1) - 1),\n   ${xShape[0]} -\n (rc + 1) - 1);\n   }\n   setOutput(result);\n }\n`;\n   } else {\n     this.userCode = `\n\n void\n main() {\n   ${type} rc = getOutputCoords();\n   vec4 result = vec4(0.);\n   result.r =\n ${getR(channels.slice())};\n   if(${nextColumn}){\n     result.g = ${getG(channels.slice())};\n   }\n\n if(${nextRow}) {\n     result.b = ${getB(channels.slice())};\n     if(${nextColumn}) {\n       result.a =\n ${getA(channels.slice())};\n     }\n   }\n   setOutput(result);\n }\n`;\n   }\n\n }\n\n\n function\n getR(channels: string[]): string {\n   return getChannel(channels);\n }\n\n function getG(channels: string[]):\n string {\n   channels[rank - 1] = '(' + channels[rank - 1] + ` + 1)`;\n   return getChannel(channels);\n }\n\n\n function getB(channels: string[]): string {\n   channels[rank - 2] = '(' + channels[rank - 2] + ` + 1)`;\n   return\n getChannel(channels);\n }\n\n\n function getA(channels: string[]): string {\n   channels[rank - 1] = '(' +\n channels[rank - 1] + ` + 1)`;\n   channels[rank - 2] = '(' + channels[rank - 2] + ` + 1)`;\n   return\n getChannel(channels);\n }\n\n\n function getChannel(channels: string[]): string {\n   const inCoordsArray =\n xShape.map( (_, i) => getInCoord(i, channels));\n   const inCoords = inCoordsArray.join(',');\n   const innerDims\n = inCoordsArray.slice(-2).join(',');\n   return `getChannel(getX(${inCoords}), vec2(${innerDims}))`;\n }\n\n\n function getInCoord(i: number, channels1: string[]): string {\n   if (axis.indexOf(i) !== -1 && xShape[i] !== 1) {\n     return `${xShape[i]} - ${channels1[i]} - 1`;\n   } else {\n     return `${channels1[i]}`;\n   }\n }\n\n }\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n * License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n * may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n * by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n * License for the specific language governing permissions and\n * limitations under the License.\n *

```

```
=====\n\n*\n\nimport {env, KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from

```



```

'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ReverseProgram}
from '../reverse_gpu';\nimport {ReversePackedProgram} from '../reverse_packed_gpu';\nimport {identity} from
'/Identity';\n\nexport function reverse(args: {\n  inputs: ReverseInputs,\n  backend: MathBackendWebGL,\n  attrs:
ReverseAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {dims} =
attrs;\n\n  const xRank = x.shape.length;\n\n  const $dims = util.parseAxisParam(dims, x.shape);\n  if (xRank === 0)
{\n    return identity({inputs: {x}, backend});\n  }\n\n  const program =
env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n    new ReversePackedProgram(x.shape, $dims) :\n    new ReverseProgram(x.shape, $dims);\n\n  return backend.runWebGLProgram(program, [x],
x.dtype);\n}\n\nexport const reverseConfig: KernelConfig = {\n  kernelName: Reverse,\n  backendName: 'webgl',\n  kernelFunc: reverse as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'/gpgpu_math';\n\nexport class RotateProgram implements GPGPUProgram {\n  variableNames = ['Image'];\n  outputShape: number[] = [];\n  userCode: string;\n\n  constructor(\n    imageShape: [number, number, number,
number],\n    radians: number,\n    fillValue: number|[number, number, number],\n    center: number|[number,
number]) {\n    const imageHeight = imageShape[1];\n    const imageWidth = imageShape[2];\n    const sinFactor =
Math.sin(radians).toFixed(3);\n    const cosFactor = Math.cos(radians).toFixed(3);\n    this.outputShape =
imageShape;\n\n    const [centerX, centerY] =\n      backend_util.getImageCenter(center, imageHeight,
imageWidth);\n    const centerXString = centerX.toFixed(3);\n    const centerYString = centerY.toFixed(3);\n\n    let
fillSnippet = ";\n    if (typeof fillValue === 'number') {\n      fillSnippet = `float outputValue =
${fillValue.toFixed(2)};`\n    } else {\n      fillSnippet = `\n      vec3 fill = vec3(${fillValue.join(',')});\n      float
outputValue = fill[coords[3]];`\n    }\n\n    this.userCode = `\n      void main() {\n        ivec4 coords =
getOutputCoords();\n        int x = coords[2];\n        int y = coords[1];\n        float coordXFloat = (float(x) -
${centerXString}) * ${\n          cosFactor} - (float(y) - ${centerYString}) * ${sinFactor};\n        float coordYFloat =
(float(x) - ${centerXString}) * ${\n          sinFactor} + (float(y) - ${centerYString}) * ${cosFactor};\n        int
coordX = int(round(coordXFloat + ${centerXString}));\n        int coordY = int(round(coordYFloat +
${centerYString}));\n        ${fillSnippet}\n        if(coordX >= 0 && coordX < ${imageWidth} && coordY >= 0
&& coordY < ${\n          imageHeight}) {\n          outputValue = getImage(coords[0], coordY, coordX, coords[3]);\n
        }\n        setOutput(outputValue);\n      }\n    `;\n  }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
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=====\n
*/\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\nimport {RotateWithOffset,
RotateWithOffsetAttrs, RotateWithOffsetInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL}
from '../backend_webgl';\nimport {RotateProgram} from '../rotate_gpu';\n\nexport const rotateWithOffsetConfig:
KernelConfig = {\n  kernelName: RotateWithOffset,\n  backendName: 'webgl',\n  kernelFunc: ({inputs, attrs,
backend}) => {\n    const {image} = inputs as RotateWithOffsetInputs;\n    const {radians, fillValue, center} = attrs
as {\n    } as RotateWithOffsetAttrs;\n    const webglBackend = backend as MathBackendWebGL;\n\n    const program

```

```

= new RotateProgram(\n      (image as Tensor4D).shape, radians, fillValue, center);\n  const output =
webglBackend.runWebGLProgram(program, [image], image.dtype);\n  return output;\n };\n", "/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst ROUND = \n // OpenGL ES does not support round function.\n // The
algorithm is based on banker's rounding.\n float base = floor(x);\n if ((x - base) < 0.5) {\n   return floor(x);\n }
else if ((x - base) > 0.5) {\n   return ceil(x);\n } else {\n   if (mod(base, 2.0) === 0.0) {\n     return base;\n   }
else {\n     return base + 1.0;\n   }\n }\n};\n\nexport const round = unaryKernelFunc({opSnippet: ROUND});\n\nexport
const roundConfig: KernelConfig = {\n  kernelName: Round,\n  backendName: 'webgl',\n  kernelFunc:
round,\n};\n", "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class ScatterProgram implements GPGPUProgram {\n  variableNames = ['updates',
'indices', 'defaultValue'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(\n    updateSize: number,
sliceDim: number, indicesRank: number,\n    updatesRank: number, strides: number[], shape: number[],\n    summingDupeIndex = true) {\n    this.outputShape = shape;\n    const stridesType =
getCoordsDataType(strides.length);\n    const dtype = getCoordsDataType(shape.length);\n    let indicesString = ";\n
if (indicesRank === 1) {\n    indicesString = 'i';\n  } else if (indicesRank === 2) {\n    indicesString = 'i, j';\n
}\n    const indicesSnippet = `getIndices(${indicesString})`; \n\n    let updatesString = ";\n    if (updatesRank === 1)
{\n    updatesString = 'i';\n  } else if (updatesRank === 2) {\n    updatesString = 'i, coords[1]';\n  }\n    const
updatesSnippet = `getUpdates(${updatesString})`; \n\n    const strideString = sliceDim > 1 ? 'strides[j]': 'strides';\n
this.userCode = \n    ${stridesType} strides = ${stridesType}(${strides});\n\n    void main() {\n    ${dtype}
coords = getOutputCoords();\n    float sum = 0.0;\n    bool found = false;\n    for (int i = 0; i <
${updateSize}; i++) {\n    int flattenedIndex = 0;\n    for (int j = 0; j < ${sliceDim}; j++) {\n    int
index = round(${indicesSnippet});\n    flattenedIndex += index * ${strideString};\n    }\n    if
(flattenedIndex == coords[0]) {\n    sum += ${updatesSnippet};\n    found = true;\n    }\n    }\n
setOutput(mix(getDefaultValue(), sum, float(found)));\n  }\n};\n", "/**\n * @license\n *
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo}
from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport

```


kernelName: Select,\n backendName: 'webgl',\n kernelFunc: select as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {backend_util, KernelConfig, Selu} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\nconst SELU =`\n // Stable and Attracting Fixed Point (0, 1) for Normalized\n Weights.\n // see: https://arxiv.org/abs/1706.02515\n float scaleAlpha =\n ${backend_util.SELU_SCALEALPHA};\n float scale = ${backend_util.SELU_SCALE};\n return (x >= 0.0) ?\n scale * x : scaleAlpha * (exp(x) - 1.0);\n\nexport const selu = unaryKernelFunc({opSnippet: SELU});\nexport\n const seluConfig: KernelConfig = {\n kernelName: Selu,\n backendName: 'webgl',\n kernelFunc:\n selu,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Sigmoid} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\nconst SIGMOID =`return 1.0 / (1.0 + exp(-1.0 * x));`\n\nexport const sigmoid = unaryKernelFunc({opSnippet: SIGMOID});\nexport const sigmoidConfig: KernelConfig = {\n kernelName: Sigmoid,\n backendName: 'webgl',\n kernelFunc: sigmoid,\n};\n", "/*\n * @license\n * Copyright\n 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Sign} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n './kernel_utils/kernel_funcs_utils';\n// Sign does not propagate NaNs.\nconst SIGN =`\n if (isnan(x)) { return\n 0.0; }\n return sign(x);\n`\n\nexport const sign = unaryKernelFunc({opSnippet: SIGN});\nexport const\n signConfig: KernelConfig = {\n kernelName: Sign,\n backendName: 'webgl',\n kernelFunc: sign,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {CHECK_NAN_SNIPPET_UNARY,\n unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\nconst SIN = CHECK_NAN_SNIPPET_UNARY +\n`\n return sin(x);\n`\n\nexport const sin = unaryKernelFunc({opSnippet: SIN});\nexport const sinConfig:\n KernelConfig = {\n kernelName: Sin,\n backendName: 'webgl',\n kernelFunc: sin,\n};\n", "/*\n * @license\n *
```

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {KernelConfig, Sinh} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from  
 './kernel_utils/kernel_funcs_utils';\n\nconst SINH = `float e2x = exp(x);\n return (e2x - 1.0 / e2x) /  
 2.0`;\n\nexport const sinh = unaryKernelFunc({opSnippet: SINH});\n\nexport const sinhConfig: KernelConfig =  
 {\n  kernelName: Sinh,\n  backendName: 'webgl',\n  kernelFunc: sinh,\n};\n\n"/**\n * @license\n * Copyright 2020  
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you  
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,  
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
 governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Softplus} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from  
 './kernel_utils/kernel_funcs_utils';\n\nconst SOFTPLUS = `float epsilon = 1.1920928955078125e-7;\n float  
 threshold = log(epsilon) + 2.0;\n bool too_large = x > -threshold;\n bool too_small = x < threshold;\n\n float  
 result;\n float exp_x = exp(x);\n\n if (too_large){\n   result = x;\n } else if (too_small){\n   result = exp_x;\n }\n else{\n   result = log(exp_x + 1.0);\n }\n return result`;\n\nexport const softplus =  
 unaryKernelFunc({opSnippet: SOFTPLUS});\n\nexport const softplusConfig: KernelConfig = {\n  kernelName:  
 Softplus,\n  backendName: 'webgl',\n  kernelFunc: softplus,\n};\n\n"/**\n * @license\n * Copyright 2020 Google  
 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not  
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
 governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, SpaceToBatchND, SpaceToBatchNDAttrs,  
 SpaceToBatchNDInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from  
 './backend_webgl';\nimport {padV2} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose}  
 from './Transpose';\n\nexport const spaceToBatchND = (args: {\n  inputs: SpaceToBatchNDInputs,\n  backend:  
 MathBackendWebGL,\n  attrs: SpaceToBatchNDAttrs\n}): TensorInfo => {\n  const {inputs, backend, attrs} =  
 args;\n  const {x} = inputs;\n  const {blockShape, paddings} = attrs;\n\n  util.assert(x.shape.length <= 4,\n    () => 'spaceToBatchND for rank > 4 with a WebGL backend not ' +  
      'implemented yet');\n\n  const prod =  
 blockShape.reduce((a, b) => a * b);\n\n  const completePaddings: Array<[number, number]> = [[0, 0];\n  completePaddings.push(...paddings as Array<[number, number]>);\n  for (let i = 1 + blockShape.length; i <  
 x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n\n  const toDispose = [];\n  const paddedX =  
 padV2({\n    inputs: {x},\n    backend,\n    attrs: {paddings: completePaddings, constantValue: 0}\n  });\n\n  const  
 reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n  const  
 permutedReshapedPaddedPermutation =  
 backend_util.getPermuted(\n    reshapedPaddedShape.length,  
 blockShape.length, false);\n\n  const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,  
 blockShape, prod, false);\n\n  const reshapedPaddedX = reshape(\n    {inputs: {x: paddedX}, backend, attrs:  
 {shape: reshapedPaddedShape}});\n\n  const paddedXT = transpose({\n    inputs: {x: reshapedPaddedX},\n
```

```

backend,\n  attrs: {perm: permutedReshapedPaddedPermutation}\n });\n\n const result =\n  reshape({inputs:
{x: paddedXT}, backend, attrs: {shape: flattenShape}});\n\n toDispose.push(paddedX);\n
toDispose.push(reshapedPaddedX);\n  toDispose.push(paddedXT);\n\n  toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return result;\n};\n\n\nexport const spaceToBatchNDConfig:
KernelConfig = {\n  kernelName: SpaceToBatchND,\n  backendName: 'webgl',\n  kernelFunc: spaceToBatchND as
{} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, SparseToDense, SparseToDenseAttrs,
SparseToDenseInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {ScatterProgram} from './scatter_gpu';\n\nimport {reshape} from './Reshape';\n\nexport
function sparseToDense(args: {\n  inputs: SparseToDenseInputs,\n  backend: MathBackendWebGL,\n  attrs:
SparseToDenseAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {sparseIndices,
sparseValues, defaultValue} = inputs;\n  const {outputShape} = attrs;\n\n  const {sliceRank, numUpdates, strides,
outputSize} =\n    backend_util.calculateShapes(sparseValues, sparseIndices, outputShape);\n\n  const
sumDupeIndices = false;\n  const program = new ScatterProgram(\n    numUpdates, sliceRank,
sparseIndices.shape.length,\n    sparseValues.shape.length, strides, [outputSize, 1], sumDupeIndices);\n\n  const res
= backend.runWebGLProgram(\n    program, [sparseValues, sparseIndices, defaultValue],
sparseValues.dtype);\n\n  const reshaped =\n    reshape({inputs: {x: res}, backend, attrs: {shape:
outputShape}});\n\n  backend.disposeIntermediateTensorInfo(res);\n  return reshaped;\n}\n\n\nexport const
sparseToDenseConfig: KernelConfig = {\n  kernelName: SparseToDense,\n  backendName: 'webgl',\n  kernelFunc:
sparseToDense as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\n\nimport {slice} from
'./Slice';\n\nexport function splitV(\n  args:\n    {inputs: SplitVInputs, backend: MathBackendWebGL, attrs:
SplitVAttrs\n})\n  TensorInfo[] {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const
{numOrSizeSplits, axis} = attrs;\n\n  const $axis = util.parseAxisParam(axis, x.shape)[0];\n  const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n\n  const xRank = x.shape.length;\n  const begin = new
Array(xRank).fill(0);\n  const size = x.shape.slice();\n\n  return splitSizes.map(s => {\n    const sliceSize =
[...size];\n    sliceSize[$axis] = s;\n    const sliceT =\n      slice({inputs: {x}, backend, attrs: {begin, size:
sliceSize}});\n    begin[$axis] += s;\n    return sliceT;\n  });\n}\n\n\nexport const splitVConfig: KernelConfig = {\n
kernelName: SplitV,\n  backendName: 'webgl',\n  kernelFunc: splitV as {} as KernelFunc\n};\n", "/*\n *
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, Sqrt} from '@tensorflow/tfjs-core';\nimport {UnaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst Sqrt = `return sqrt(x);`\n\nexport const sqrt = unaryKernelFunc({opSnippet: Sqrt});\n\nexport const sqrtConfig: KernelConfig = {\n  kernelName: Sqrt,\n  backendName: 'webgl',\n  kernelFunc: sqrt as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {UnaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst Square = `return x * x;`\n\nexport const square = unaryKernelFunc({opSnippet: SQUARE});\n\nexport const squareConfig: KernelConfig = {\n  kernelName: Square,\n  backendName: 'webgl',\n  kernelFunc: square,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, TensorInfo, UnaryInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {CHECK_NAN_SNIPPET, UnaryOpProgram} from './unaryop_gpu';\n\nexport function step(\n  inputs: UnaryInputs,\n  attrs: StepAttrs,\n  backend: MathBackendWebGL):\n  TensorInfo {\n  const {x} = inputs;\n  const opSnippet = CHECK_NAN_SNIPPET + `\n  return x > 0.0 ? 1.0 : float(${attrs.alpha});`\n  const program = new UnaryOpProgram(x.shape, opSnippet);\n  return backend.runWebGLProgram(program, [x], x.dtype);\n}\n\nexport const stepConfig: KernelConfig = {\n  kernelName: Step,\n  backendName: 'webgl',\n  kernelFunc: step as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class StridedSliceProgram implements GPGPUProgram {\n  variableNames = ['x'];\n  outputShape: number[];\n  userCode: string;\n\n  constructor(\n    begin: number[],\n    strides: number[],\n    size: number[]) {\n    this.outputShape = size;\n    const rank = size.length;\n    const inputDtype = getCoordsDataType(size.length);\n    const dtype = getCoordsDataType(size.length);\n    let newCoords = `;\n    if (rank === 1) {\n      newCoords = 'coords * strides + begin';\n    } else {\n      let outputAxis = 0;\n      newCoords =\n        size.map((_, i) => {\n          outputAxis++;\n          return size.length === 1 ?\n            `coords * strides[${i}] + begin[${i}]`\n            : `coords[${outputAxis - 1}] * strides[${i}] + begin[${i}]`; \n        })\n        .join(',')\n    }\n  }\n\n
```


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```
=====\n*\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst TANH = `float e2x = exp(-2.0 * abs(x));\nreturn sign(x) * (1.0 - e2x) / (1.0 + e2x);`\n\nexport const tanh = unaryKernelFunc({opSnippet: TANH});\n\nexport const tanhConfig: KernelConfig = {\n  kernelName: Tanh,\n  backendName: 'webgl',\n  kernelFunc: tanh,\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n\n
```

```
=====\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class TileProgram implements GPGPUProgram {\n  variableNames = ['A'];\n  outputShape: number[];\n  userCode: string;\n  rank: number;\n\n  constructor(aShape: number[], reps: number[]) {\n    const outputShape: number[] = new Array(aShape.length);\n    for (let i = 0; i < outputShape.length; i++) {\n      outputShape[i] = aShape[i] * reps[i];\n    }\n    this.outputShape = outputShape;\n    this.rank = outputShape.length;\n    const dtype = getCoordsDataType(this.rank);\n    const sourceCoords = getSourceCoords(aShape);\n\n    this.userCode = `\n    void main() {\n      ${dtype} resRC = getOutputCoords();\n      setOutput(getA(${sourceCoords}));\n    }\n  `;\n\n  function getSourceCoords(aShape: number[]): string {\n    const rank = aShape.length;\n    if (rank > 5) {\n      throw Error(`Tile for rank ${rank} is not yet supported`);\n    }\n    if (rank === 1) {\n      return `imod(resRC, ${aShape[0]}`;\n    }\n\n    const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w', 'resRC.u'];\n    const sourceCoords = [];\n    for (let i = 0; i < aShape.length; i++) {\n      sourceCoords.push(`imod(${currentCoords[i]}, ${aShape[i]}`);\n    }\n    return sourceCoords.join();\n  }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n\n
```

```
=====\n*\n\nimport {buffer, KernelConfig, KernelFunc, TensorInfo, Tile, TileAttrs, TileInputs, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {tileImplCPU} from './kernel_utils/shared';\nimport {TileProgram} from './tile_gpu';\n\nexport function tile(\n  params: {\n    inputs: TileInputs,\n    backend: MathBackendWebGL,\n    attrs: TileAttrs,\n  }): TensorInfo {\n  const {inputs, backend, attrs} = params;\n  const {x} = inputs;\n  const {reps} = attrs;\n\n  if (x.dtype === 'string') {\n    // Even though string tensor is always on CPU, just to be consistent on how\n    // to access tensor data.\n    const data = backend.readSync(x.dataId) as Uint8Array[];\n    const decodedData = data.map(d => util.decodeString(d));\n    const buf = buffer(x.shape, x.dtype, decodedData);\n    const outBuf = tileImplCPU(buf, reps);\n    return backend.makeTensorInfo(outBuf.shape, outBuf.dtype, outBuf.values);\n  }\n\n  const program = new TileProgram(x.shape, reps);\n  const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n  return output;\n}\n\nexport const tileConfig: KernelConfig = {\n  kernelName: Tile,\n  backendName: 'webgl',\n  kernelFunc: tile as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n\n
```

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```
=====
*\n\nimport { KernelConfig, KernelFunc, NumericDataType, TensorInfo, TopK, TopKAttrs, TopKInputs,
TypedArray } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\n\nimport
{ topKImplCPU } from './kernel_utils/shared';\n\n\nexport function topK(\n  args: { inputs: TopKInputs, backend:
MathBackendWebGL, attrs: TopKAttrs }):\n  TensorInfo[] {\n  const { inputs, backend, attrs } = args;\n  const { x } =
inputs;\n  const { k, sorted } = attrs;\n  const xVals = backend.readSync(x.dataId) as TypedArray;\n  const
[allTopKVals, allTopKIndices] =\n    topKImplCPU(xVals, x.shape, x.dtype as NumericDataType, k, sorted);\n  return [\n    backend.makeTensorInfo(\n      allTopKVals.shape, allTopKVals.dtype, allTopKVals.values),\n    backend.makeTensorInfo(\n      allTopKIndices.shape, allTopKIndices.dtype, allTopKIndices.values)\n  ];\n}\n\n\nexport const topKConfig: KernelConfig = {\n  kernelName: TopK,\n  backendName: 'webgl',\n  kernelFunc: topK as { } as KernelFunc\n};\n\n", /*\n * @license\n * Copyright 2020 Google LLC. All Rights
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```
=====
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unique, UniqueAttrs, UniqueInputs } from '@tensorflow/tfjs-
core';\n\nimport { MathBackendWebGL } from './backend_webgl';\n\nimport { uniqueImplCPU } from
 './kernel_utils/shared';\n\nimport { assertNotComplex } from './webgl_util';\n\n\nexport function unique(\n  args:\n  { inputs: UniqueInputs, attrs: UniqueAttrs, backend: MathBackendWebGL }):\n  TensorInfo[] {\n  const { inputs,
attrs, backend } = args;\n  const { axis } = attrs;\n  const { x } = inputs;\n  assertNotComplex(x, 'unique');\n  \n  // For
now, always forward calculation to the CPU backend.\n  console.warn(\n    'WARNING: ',\n    'UI might be
locked temporarily as data is being downloaded');\n  const values = backend.readSync(x.dataId);\n  const
{ outputValues, outputShape, indices } =\n    uniqueImplCPU(values, axis, x.shape, x.dtype);\n  return [\n
backend.makeTensorInfo(outputShape, x.dtype, outputValues),\n    backend.makeTensorInfo([indices.length],
'int32', indices),\n  ];\n}\n\n\nexport const uniqueConfig: KernelConfig = {\n  kernelName: Unique,\n  backendName:
'webgl',\n  kernelFunc: unique as { } as KernelFunc\n};\n\n", /*\n * @license\n * Copyright 2020 Google LLC. All
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```
=====
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
 '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\n\nimport { reshape } from
 './Reshape';\n\nimport { slice } from './Slice';\n\n\nexport function unpack(\n  args:\n  { inputs: UnpackInputs,
backend: MathBackendWebGL, attrs: UnpackAttrs }):\n  TensorInfo[] {\n  const { inputs, backend, attrs } = args;\n
const { value } = inputs;\n  let { axis } = attrs;\n  \n  if (axis < 0) {\n    axis += value.shape.length;\n  }\n  \n  const x =
value;\n  const xRank = x.shape.length;\n  const num = value.shape[axis];\n  const outShape: number[] = new
Array(xRank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < xRank; i++) {\n    if (i !== axis) {\n
outShape[outIndex++] = x.shape[i];\n    }\n  }\n  \n  const toDispose = [];\n  const begin = new

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Array(xRank).fill(0);\n const size = x.shape.slice();\n size[axis] = 1;\n const res: TensorInfo[] = new
Array(num);\n for (let i = 0; i < res.length; i++) {\n begin[axis] = i;\n const sliced = slice({inputs: {x}, backend,
attrs: {begin, size}});\n const reshaped =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:
outShape}});\n res[i] = reshaped;\n\n toDispose.push(sliced);\n }\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t);\n return res;\n}\n\nexport const unpackConfig: KernelConfig = {\n
kernelName: Unpack,\n backendName: 'webgl',\n kernelFunc: unpack as {} as KernelFunc\n};\n\n"/**\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class SegmentOpProgram implements GPGPUProgram {\n variableNames = ['x',
'segmentIds'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n segOpInfo:
backend_util.segment_util.SegOpInfo,\n segOpType: 'unsortedSegmentSum') {\n const windowSize =
segOpInfo.windowSize;\n const batchSize = segOpInfo.batchSize;\n const inSize = segOpInfo.inSize;\n const
numSegments = segOpInfo.numSegments;\n const outSize = numSegments * Math.ceil(inSize / windowSize);\n
this.outputShape = [batchSize, outSize];\n\n const initializationValue = '0.0';\n const returnValue =
`sumValue`;\n\n const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n const
windowSizeVec4Remainder = windowSize % 4;\n\n const updateSnippet = `\n sumValue += dot(values,
segFilter);\n `;\n\n let checkValueOutOfBounds = ";\n if (inSize % windowSize > 0) {\n
checkValueOutOfBounds = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return initializationValue;\n }\n
`;\n }\n\n let checkSegmentIdOutOfBounds = ";\n if (inSize % windowSize > 0) {\n
checkSegmentIdOutOfBounds = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return -1.0;\n }\n `;\n
}\n\n this.userCode = `\n const float initializationValue = ${initializationValue};\n\n float
getValue(int batch, int inIdx) {\n ${checkValueOutOfBounds}\n return getX(batch, inIdx);\n }\n\n float
getSegmentIdAtIndex(int inIdx) {\n ${checkSegmentIdOutOfBounds}\n return getSegmentIds(inIdx);\n
}\n\n void main() {\n ivec2 coords = getOutputCoords();\n int batch = coords[0];\n int outIdx =
coords[1];\n int inOffset = int(floor(float(outIdx) / float(\n ${numSegments})) * float(${windowSize}));\n
int currentSeg = int(mod(float(outIdx), float(${numSegments})));;\n\n float sumValue = 0.0;\n\n for (int
i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n int inIdx = inOffset + i;\n vec4 values = vec4(\n
getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n
getValue(batch, inIdx + 3)\n );\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n
int(getSegmentIdAtIndex(inIdx + 2)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 3)) ==
currentSeg ? 1 : 0\n );\n\n ${updateSnippet}\n }\n\n int inIdx = inOffset +
${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder} === 1) {\n vec4 values = vec4(\n
getValue(batch, inIdx),\n initializationValue,\n initializationValue,\n initializationValue\n
);\n\n int inIdxSeg = int(getSegmentIdAtIndex(inIdx));\n\n vec4 segFilter = vec4(\n
int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n 0,\n 0,\n 0\n );\n\n
${updateSnippet}\n } else if (${windowSizeVec4Remainder} === 2) {\n vec4 values = vec4(\n
getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n initializationValue,\n
initializationValue\n );\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n 0,\n 0\n
);\n\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder} === 3) {\n vec4 values =
vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n

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    initializationValue\n    );\n    vec4 segFilter = vec4(\n        int(getSegmentIdAtIndex(inIdx)) ==
currentSeg ? 1 : 0,\n        int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n        int(getSegmentIdAtIndex(inIdx + 2)) == currentSeg ? 1 : 0,\n        0\n    );\n    ${updateSnippet}\n
}\n    setOutput(${returnValue});\n    }\n    `;\n    }\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport { backend_util, DataType, KernelConfig, KernelFunc, sumOutType, TensorInfo,
UnsortedSegmentSum, UnsortedSegmentSumAttrs, UnsortedSegmentSumInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { SegmentOpProgram } from
'./segment_gpu';\n\nimport { range } from './Range';\nimport { reshape } from './Reshape';\nimport { tile } from
'./Tile';\nimport { transpose } from './Transpose';\n\nexport function unsortedSegmentSum(args: {\n inputs:
UnsortedSegmentSumInputs,\n backend: MathBackendWebGL,\n attrs: UnsortedSegmentSumAttrs\n}):
TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x, segmentIds } = inputs;\n const { numSegments } =
attrs;\n\n const xRank = x.shape.length;\n\n const toDispose = [];\n\n let axis = 0;\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation != null) {\n permutedX
= transpose({ inputs: { x }, backend, attrs: { perm: permutation } });\n toDispose.push(permutedX);\n axis =
backend_util.getInnerMostAxes(1, xRank)[0];\n }\n\n const outShape =
backend_util.segment_util.computeOutShape(\n permutedX.shape, axis, numSegments);\n\n const inSize =
util.sizeFromShape([permutedX.shape[axis]]);\n\n const a2D =\n reshape({ inputs: { x: permutedX }, backend, attrs:
{ shape: [-1, inSize] } });\n\n toDispose.push(a2D);\n\n const outputDType = sumOutType(x.dtype);\n\n const
segOpCompute =\n (x: TensorInfo, segOpType: 'unsortedSegmentSum', segmentIds: TensorInfo,\n dtype:
DataType, numSegments: number): TensorInfo => {\n const batchSize = x.shape[0];\n const inSize =
x.shape[1];\n const windowSize =\n backend_util.segment_util.segOpComputeOptimalWindowSize(\n
inSize, numSegments);\n const segOpInfo = { windowSize, inSize, batchSize, numSegments }; \n
const program = new SegmentOpProgram(segOpInfo, segOpType);\n const output =
backend.compileAndRun(program, [x, segmentIds], dtype);\n toDispose.push(output);\n // No need to run
another GPGPU program.\n if (output.shape[1] === numSegments) {\n return output;\n }\n\n const
rangeInfo = range({\n backend,\n attrs: { start: 0, stop: numSegments, step: 1, dtype: 'float32' }\n });\n
const tileInfo = tile({\n inputs: { x: rangeInfo },\n backend,\n attrs: { reps: [inSize /
windowSize] }\n });\n\n toDispose.push(rangeInfo);\n toDispose.push(tileInfo);\n\n const result =\n segOpCompute(output, segOpType, tileInfo, dtype, numSegments);\n return result;\n }; \n\n const
segOpResult = segOpCompute(\n a2D, 'unsortedSegmentSum', segmentIds, outputDType, numSegments);\n\n
const reshaped =\n reshape({ inputs: { x: segOpResult }, backend, attrs: { shape: outShape } });\n\n let result =
reshaped;\n if (permutation != null) {\n toDispose.push(reshaped);\n const perm =
backend_util.getUndoAxesPermutation(permutation);\n result = transpose({ inputs: { x: result }, backend, attrs:
{ perm } });\n }\n\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return
result;\n }\n\nexport const unsortedSegmentSumConfig: KernelConfig = {\n kernelName: UnsortedSegmentSum,\n backendName: 'webgl',\n kernelFunc: unsortedSegmentSum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for

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the specific language governing permissions and\n * limitations under the License.\n *

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=====\n*\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {_fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {acosConfig} from './kernels/Acos';\nimport {acoshConfig} from './kernels/Acosh';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {argMinConfig} from './kernels/ArgMin';\nimport {asinConfig} from './kernels/Asin';\nimport {asinhConfig} from './kernels/Asinh';\nimport {atanConfig} from './kernels/Atan';\nimport {atan2Config} from './kernels/Atan2';\nimport {atanhConfig} from './kernels/Atanh';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {avgPool3DConfig} from './kernels/AvgPool3D';\nimport {avgPoolGrad3DConfig} from './kernels/AvgPool3DGrad';\nimport {avgPoolGradConfig} from './kernels/AvgPoolGrad';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchNormConfig} from './kernels/BatchNorm';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {bincountConfig} from './kernels/Bincount';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {complexConfig} from './kernels/Complex';\nimport {complexAbsConfig} from './kernels/ComplexAbs';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropFilterConfig} from './kernels/Conv2DBackpropFilter';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {conv3DConfig} from './kernels/Conv3D';\nimport {conv3DBackpropFilterV2Config} from './kernels/Conv3DBackpropFilterV2';\nimport {conv3DBackpropInputConfig} from './kernels/Conv3DBackpropInputV2';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {denseBincountConfig} from './kernels/DenseBincount';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport {depthwiseConv2dNativeBackpropFilterConfig} from './kernels/DepthwiseConv2dNativeBackpropFilter';\nimport {depthwiseConv2dNativeBackpropInputConfig} from './kernels/DepthwiseConv2dNativeBackpropInput';\nimport {diagConfig} from './kernels/Diag';\nimport {dilation2DConfig} from './kernels/Dilation2D';\nimport {eluConfig} from './kernels/Elu';\nimport {eluGradConfig} from './kernels/EluGrad';\nimport {equalConfig} from './kernels/Equal';\nimport {erfConfig} from './kernels/Erf';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from './kernels/ExpandDims';\nimport {expm1Config} from './kernels/Expm1';\nimport {fftConfig} from './kernels/FFT';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from './kernels/FloorDiv';\nimport {fromPixelsConfig} from './kernels/FromPixels';\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport {ifftConfig} from './kernels/IFFT';\nimport {imagConfig} from './kernels/Imag';\nimport {isFiniteConfig} from './kernels/IsFinite';\nimport {isInfConfig} from './kernels/IsInf';\nimport {isNaNConfig} from './kernels/IsNaN';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {linSpaceConfig} from './kernels/LinSpace';\nimport {logConfig} from './kernels/Log';\nimport {log1pConfig} from './kernels/Log1p';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {logicalNotConfig} from './kernels/LogicalNot';\nimport {logicalOrConfig} from './kernels/LogicalOr';\nimport {LRNConfig} from './kernels/LRN';\nimport {LRNGradConfig} from './kernels/LRNGrad';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from
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./kernels/MaxPool';\nimport {maxPool3DConfig} from './kernels/MaxPool3D';\nimport {maxPoolGrad3DConfig}
from './kernels/MaxPool3DGrad';\nimport {maxPoolGradConfig} from './kernels/MaxPoolGrad';\nimport
{maxPoolWithArgmaxConfig} from './kernels/MaxPoolWithArgmax';\nimport {meanConfig} from
./kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {modConfig} from
./kernels/Mod';\nimport {multinomialConfig} from './kernels/Multinomial';\nimport {multiplyConfig} from
./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realConfig} from './kernels/Real';\nimport {realDivConfig} from
./kernels/RealDiv';\nimport {reciprocalConfig} from './kernels/Reciprocal';\nimport {reluConfig} from
./kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport
{resizeBilinearGradConfig} from './kernels/ResizeBilinearGrad';\nimport {resizeNearestNeighborConfig} from
./kernels/ResizeNearestNeighbor';\nimport {resizeNearestNeighborGradConfig} from
./kernels/ResizeNearestNeighborGrad';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
./kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {seluConfig} from
./kernels/Selu';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {signConfig} from
./kernels/Sign';\nimport {sinConfig} from './kernels/Sin';\nimport {sinhConfig} from './kernels/Sinh';\nimport
{sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from './kernels/Softmax';\nimport {softplusConfig}
from './kernels/Softplus';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport
{sparseToDenseConfig} from './kernels/SparseToDense';\nimport {splitVConfig} from './kernels/SplitV';\nimport
{sqrtConfig} from './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport
{squaredDifferenceConfig} from './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport
{stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transposeConfig} from
./kernels/Transpose';\nimport {uniqueConfig} from './kernels/Unique';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {unsortedSegmentSumConfig} from './kernels/UnsortedSegmentSum';\nimport
{zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst kernelConfigs:
KernelConfig[] = [\n  LRNConfig,\n  LRNGradConfig,\n  _fusedMatMulConfig,\n  absConfig,\n  acosConfig,\n  acoshConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  argMinConfig,\n  asinConfig,\n  asinhConfig,\n  atan2Config,\n  atanConfig,\n  atanhConfig,\n  avgPool3DConfig,\n  avgPoolConfig,\n  avgPoolGrad3DConfig,\n  avgPoolGradConfig,\n  batchMatMulConfig,\n  batchNormConfig,\n  batchToSpaceNDConfig,\n  bincountConfig,\n  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  complexAbsConfig,\n  complexConfig,\n  concatConfig,\n  conv2DBackpropFilterConfig,\n  conv2DBackpropInputConfig,\n  conv2DConfig,\n  conv3DBackpropFilterV2Config,\n  conv3DBackpropInputConfig,\n  conv3DConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  denseBincountConfig,\n  depthToSpaceConfig,\n  depthwiseConv2dNativeBackpropFilterConfig,\n  depthwiseConv2dNativeBackpropInputConfig,\n  depthwiseConv2dNativeConfig,\n  diagConfig,\n  dilation2DConfig,\n  eluConfig,\n  eluGradConfig,\n  equalConfig,\n  erfConfig,\n  expConfig,\n  expandDimsConfig,\n  expm1Config,\n  fftConfig,\n  fillConfig,\n

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s?: (string|null);\n\n /** AttrValue i */\n i?: (number|string|null);\n\n /** AttrValue f */\n f?: (number|null);\n\n /** AttrValue b */\n b?: (boolean|null);\n\n /** AttrValue type */\n type?: (DataType|null);\n\n /** AttrValue shape */\n shape?: (ITensorShape|null);\n\n /** AttrValue tensor */\n tensor?: (ITensor|null);\n\n /** AttrValue placeholder */\n placeholder?: (string|null);\n\n /** AttrValue func */\n func?: (INameAttrList|null);\n\n\nexport namespace AttrValue {\n /** Properties of a ListValue. */\n export declare interface IListValue {\n /** ListValue s */\n s?: (string[])|null);\n\n /** ListValue i */\n i?: ((number | string)[])|null);\n\n /** ListValue f */\n f?: (number[])|null);\n\n /** ListValue b */\n b?: (boolean[])|null);\n\n /** ListValue type */\n type?: (DataType[])|null);\n\n /** ListValue shape */\n shape?: (ITensorShape[])|null);\n\n /** ListValue tensor */\n tensor?: (ITensor[])|null);\n\n /** ListValue func */\n func?: (INameAttrList[])|null);\n }\n\n\n/** Properties of a NameAttrList. */\nexport declare interface INameAttrList {\n /** NameAttrList name */\n name?: (string|null);\n\n /** NameAttrList attr */\n attr?: ({[k: string]: IAttrValue})|null);\n }\n\n\n/** Properties of a NodeDef. */\nexport declare interface INodeDef {\n /** NodeDef name */\n name?: (string|null);\n\n /** NodeDef op */\n op?: (string|null);\n\n /** NodeDef input */\n input?: (string[])|null);\n\n /** NodeDef device */\n device?: (string|null);\n\n /** NodeDef attr */\n attr?: ({[k: string]: IAttrValue})|null);\n }\n\n\n/** Properties of a VersionDef. */\nexport declare interface IVersionDef {\n /** VersionDef producer */\n producer?: (number|null);\n\n /** VersionDef minConsumer */\n minConsumer?: (number|null);\n\n /** VersionDef badConsumers */\n badConsumers?: (number[])|null);\n }\n\n\n/** Properties of a GraphDef. */\nexport declare interface IGraphDef {\n /** GraphDef node */\n node?: (INodeDef[])|null);\n\n /** GraphDef versions */\n versions?: (IVersionDef|null);\n\n /** GraphDef library */\n library?: (IFunctionDefLibrary|null);\n }\n\n\n/** Properties of a CollectionDef. */\nexport declare interface ICollectionDef {\n /** CollectionDef nodeList */\n nodeList?: (CollectionDef.INodeList|null);\n\n /** CollectionDef bytesList */\n bytesList?: (CollectionDef.IBytesList|null);\n\n /** CollectionDef int64List */\n int64List?: (CollectionDef.IInt64List|null);\n\n /** CollectionDef floatList */\n floatList?: (CollectionDef.IFloatList|null);\n\n /** CollectionDef anyList */\n anyList?: (CollectionDef.IAnyList|null);\n }\n\n\nexport namespace CollectionDef {\n /** Properties of a NodeList. */\n export declare interface INodeList {\n /** NodeList value */\n value?: (string[])|null);\n }\n\n /** Properties of a BytesList. */\n export declare interface IBytesList {\n /** BytesList value */\n value?: (Uint8Array[])|null);\n }\n\n /** Properties of an Int64List. */\n export declare interface IInt64List {\n /** Int64List value */\n value?: ((number | string)[])|null);\n }\n\n /** Properties of a FloatList. */\n export declare interface IFloatList {\n /** FloatList value */\n value?: (number[])|null);\n }\n\n /** Properties of an AnyList. */\n export declare interface IAnyList {\n /** AnyList value */\n value?: (IAny[])|null);\n }\n }\n\n\n/** Properties of a SaverDef. */\nexport declare interface ISaverDef {\n /** SaverDef filenameTensorName */\n filenameTensorName?: (string|null);\n\n /** SaverDef saveTensorName */\n saveTensorName?: (string|null);\n\n /** SaverDef restoreOpName */\n restoreOpName?: (string|null);\n\n /** SaverDef maxToKeep */\n maxToKeep?: (number|null);\n\n /** SaverDef sharded */\n sharded?: (boolean|null);\n\n /** SaverDef keepCheckpointEveryNHours */\n keepCheckpointEveryNHours?: (number|null);\n\n /** SaverDef version */\n version?: (SaverDef.CheckpointFormatVersion|null);\n }\n\n\nexport namespace SaverDef {\n /** CheckpointFormatVersion enum. */\n export enum CheckpointFormatVersion {\n 'LEGACY' = 0, 'V1' = 1, 'V2' = 2\n }\n\n\n/** Properties of a TensorInfo. */\nexport declare interface ITensorInfo {\n /** TensorInfo name */\n name?: (string|null);\n\n /** TensorInfo cooSparse */\n cooSparse?: (TensorInfo.ICooSparse|null);\n\n /** TensorInfo dtype */\n dtype?: (DataType|null);\n\n /** TensorInfo tensorShape */\n tensorShape?: (ITensorShape|null);\n }\n\n\nexport namespace TensorInfo {\n /** Properties of a CooSparse. */\n export declare interface ICooSparse {\n /** CooSparse valuesTensorName */\n valuesTensorName?: (string|null);\n\n /** CooSparse indicesTensorName */\n indicesTensorName?: (string|null);\n\n /** CooSparse denseShapeTensorName */\n denseShapeTensorName?: (string|null);\n }\n }\n\n\n/** Properties of a SignatureDef. */\nexport declare interface ISignatureDef {\n /** SignatureDef inputs */\n inputs?: ({[k: string]: ITensorInfo})|null);\n\n /** SignatureDef outputs */\n outputs?: ({[k: string]: ITensorInfo})|null);\n\n /** SignatureDef methodName */\n methodName?: (string|null);\n }\n\n\n/** Properties of an AssetFileDef. */\nexport declare interface IAssetFileDef {\n /** AssetFileDef tensorInfo */\n tensorInfo?:

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(ITensorInfo|null);\n\n /** AssetFileDef filename *\n filename?: (string|null);\n}\n\n/** Properties of an OpDef.
*\nexport declare interface IOpDef {\n /** OpDef name *\n name?: (string|null);\n /** OpDef inputArg *\n
inputArg?: (OpDef.IArgDef[]|null);\n\n /** OpDef outputArg *\n outputArg?: (OpDef.IArgDef[]|null);\n\n /**
OpDef attr *\n attr?: (OpDef.IAttrDef[]|null);\n\n /** OpDef deprecation *\n deprecation?:
(OpDef.IOpDeprecation|null);\n\n /** OpDef summary *\n summary?: (string|null);\n\n /** OpDef description
*\n description?: (string|null);\n\n /** OpDef isCommutative *\n isCommutative?: (boolean|null);\n\n /** OpDef
isAggregate *\n isAggregate?: (boolean|null);\n\n /** OpDef isStateful *\n isStateful?: (boolean|null);\n\n /**
OpDef allowsUninitializedInput *\n allowsUninitializedInput?: (boolean|null);\n}\n\nexport namespace OpDef {\n
/** Properties of an ArgDef. *\n export declare interface IArgDef {\n /** ArgDef name *\n name?:
(string|null);\n\n /** ArgDef description *\n description?: (string|null);\n\n /** ArgDef type *\n type?:
(DataType|null);\n\n /** ArgDef typeAttr *\n typeAttr?: (string|null);\n\n /** ArgDef numberAttr *\n
numberAttr?: (string|null);\n\n /** ArgDef typeListAttr *\n typeListAttr?: (string|null);\n\n /** ArgDef isRef
*\n isRef?: (boolean|null);\n }\n\n /** Properties of an AttrDef. *\n export declare interface IAttrDef {\n /**
AttrDef name *\n name?: (string|null);\n\n /** AttrDef type *\n type?: (string|null);\n\n /** AttrDef
defaultValue *\n defaultValue?: (IAttrValue|null);\n\n /** AttrDef description *\n description?:
(string|null);\n\n /** AttrDef hasMinimum *\n hasMinimum?: (boolean|null);\n\n /** AttrDef minimum *\n
minimum?: (number|string|null);\n\n /** AttrDef allowedValues *\n allowedValues?: (IAttrValue|null);\n }\n\n
/** Properties of an OpDeprecation. *\n export declare interface IOpDeprecation {\n /** OpDeprecation version
*\n version?: (number|null);\n\n /** OpDeprecation explanation *\n explanation?: (string|null);\n }\n}\n\n/**
Properties of an OpList. *\nexport declare interface IOpList {\n /** OpList op *\n op?: (IOpDef[]|null);\n}\n\n/**
Properties of a MetaGraphDef. *\nexport declare interface IMetaGraphDef {\n /** MetaGraphDef metaInfoDef
*\n metaInfoDef?: (MetaGraphDef.IMetaInfoDef|null);\n\n /** MetaGraphDef graphDef *\n graphDef?:
(IGraphDef|null);\n\n /** MetaGraphDef saverDef *\n saverDef?: (ISaverDef|null);\n\n /** MetaGraphDef
collectionDef *\n collectionDef?: ({[k: string]: ICollectionDef}|null);\n\n /** MetaGraphDef signatureDef *\n
signatureDef?: ({[k: string]: ISignatureDef}|null);\n\n /** MetaGraphDef assetFileDef *\n assetFileDef?:
(IAssetFileDef[]|null);\n}\n\nexport namespace MetaGraphDef {\n /** Properties of a MetaInfoDef. *\n export
declare interface IMetaInfoDef {\n /** MetaInfoDef metaGraphVersion *\n metaGraphVersion?:
(string|null);\n\n /** MetaInfoDef strippedOpList *\n strippedOpList?: (IOpList|null);\n\n /** MetaInfoDef
anyInfo *\n anyInfo?: (IAny|null);\n\n /** MetaInfoDef tags *\n tags?: (string[]|null);\n\n /** MetaInfoDef
tensorflowVersion *\n tensorflowVersion?: (string|null);\n\n /** MetaInfoDef tensorflowGitVersion *\n
tensorflowGitVersion?: (string|null);\n }\n}\n\n/** Properties of a SavedModel. *\nexport declare interface
ISavedModel {\n /** SavedModel savedModelSchemaVersion *\n savedModelSchemaVersion?:
(number|string|null);\n\n /** SavedModel metaGraphs *\n metaGraphs?: (IMetaGraphDef[]|null);\n}\n\n/**
Properties of a FunctionDefLibrary. *\nexport declare interface IFunctionDefLibrary {\n /** FunctionDefLibrary
function *\n 'function': (IFunctionDef[]|null);\n\n /** FunctionDefLibrary gradient *\n gradient?:
(IGradientDef[]|null);\n}\n\n/** Properties of a FunctionDef. *\nexport declare interface IFunctionDef {\n /**
FunctionDef signature *\n signature?: (IOpDef|null);\n\n /** FunctionDef attr *\n attr?: ({[k: string]:
IAttrValue}|null);\n\n /** FunctionDef nodeDef *\n nodeDef?: (INodeDef[]|null);\n\n /** FunctionDef ret *\n
ret?: ({[k: string]: string}|null);\n}\n\n/** Properties of a GradientDef. *\nexport declare interface IGradientDef {\n
/** GradientDef functionName *\n functionName?: (string|null);\n\n /** GradientDef gradientFunc *\n
gradientFunc?: (string|null);\n}\n\n", "\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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the tensors based on input name for current context.\n * @param name Node input name\n * @param tensorsMap
Tensors map keyed by the node\n */\nexport function getTensorsForCurrentContext(\n  name: string, tensorsMap:
NamedTensorsMap,\n  context: ExecutionContext): Tensor[] {\n  return
tensorsMap[getNodeNameWithContextId(name, context.currentContextId)];\n}\n\n/**\n * Returns the node name
and index from the Node input name.\n * @param inputName The input name of the node, in format of\n *
node_name:output_index, i.e. MatMul:0, if the output_index is not set, it is\n * default to 0.\n */\nexport function
getNodeNameAndIndex(\n  inputName: string, context?: ExecutionContext): [string, number] {\n  const
[nodeName, index] = parseNodeName(inputName);\n\n  return [\n    getNodeNameWithContextId(nodeName,
context && context.currentContextId),\n    index\n  ];\n}\n\nfunction getNodeNameWithContextId(name: string,
contextId?: string): string {\n  return `!!contextId ? `-${name}-${contextId}` : name;\n}\n\nexport function
parseNodeName(name: string): [string, number] {\n  const parts = name.split(':');\n  if (parts.length === 1) {\n
return [name, 0];\n  }\n\n  const nodeName = parts[0];\n  return [nodeName, Number(parts[parts.length -
1])];\n}\n\nexport function split(arr: number[], size: number) {\n  const res = [];\n  for (let i = 0; i < arr.length; i +=
size) {\n    res.push(arr.slice(i, i + size));\n  }\n  return res;\n}\n\nexport function getPadding(\n  node: Node,
tensorMap: NamedTensorsMap,\n  context: ExecutionContext): ValueType {\n  let pad = getParamValue('pad',
node, tensorMap, context);\n  if (pad === 'explicit') {\n    // This is 1d array, we need to convert it to 2d array\n
pad = getParamValue('explicitPaddings', node, tensorMap, context);\n    const explicitPadding: [\n      [number,
number], [number, number], [number, number], [number, number]\n    ] = [[0, 0], [0, 0], [0, 0], [0, 0]];
for (let i = 0; i < 4; i++) {\n      explicitPadding[i][0] = (pad as number[])[i * 2];\n      explicitPadding[i][1] = (pad as
number[])[i * 2 + 1];\n    }\n    return explicitPadding;\n  }\n  return pad;\n}\n\n/**\n * Reuse the tensor if it is
marked as keep, otherwise clone the tensor to\n * avoid disposal. This is important for TensorArray and TensorList
ops, since\n * internally they use a tensor as the id for TensorArray and TensorList, and\n * to simplify lookup, they
also use Tensor.id as the key to the internal map.\n * These id tensors have been marked as kept in the backend, we
need avoid clone\n * them in order to create new Tensor.id.\n * @param tensor\n */\nexport function
cloneTensor(tensor: Tensor): Tensor {\n  return tensor.kept ? tensor : clone(tensor);\n}\n\n"/**\n * @license\n *
Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

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*/\n\nimport {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'Add',\n
'category': 'arithmetic',\n    'inputs': [\n      {'start': 0, 'name': 'a', 'type': 'tensor'},\n      {'start': 1, 'name': 'b', 'type':
'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ],\n    {\n
'tfOpName': 'AddV2',\n    'category': 'arithmetic',\n    'inputs': [\n      {'start': 0, 'name': 'a', 'type': 'tensor'},\n
      {'start': 1, 'name': 'b', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype',
'notSupported': true}\n    ],\n    {\n      'tfOpName': 'AddN',\n      'category': 'arithmetic',\n      'inputs': [{ 'start': 0, 'end':
0, 'name': 'tensors', 'type': 'tensors'}]\n    },\n    {\n      'tfOpName': 'BiasAdd',\n      'category': 'arithmetic',\n      'inputs': [\n
        {'start': 0, 'name': 'a', 'type': 'tensor'},\n        {'start': 1, 'name': 'b', 'type': 'tensor'},\n      ],\n      'attrs': [\n
        {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true},\n        {'tfName': 'data_format',\n          'name': 'dataFormat',\n
          'type': 'string',\n          'notSupported': true}\n      ]\n    },\n    {\n      'tfOpName': 'Sub',\n      'category': 'arithmetic',\n
      'inputs': [\n        {'start': 0, 'name': 'a', 'type': 'tensor'},\n        {'start': 1, 'name': 'b', 'type': 'tensor'},\n      ],\n      'attrs': [\n
        {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n      ]\n    },\n    {\n      'tfOpName': 'RealDiv',\n
      'category': 'arithmetic',\n      'inputs': [\n        {'start': 0, 'name': 'a', 'type': 'tensor'},\n        {'start': 1, 'name': 'b', 'type':
'tensor'},\n      ],\n      'attrs': [\n        {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n      ]\n    },\n    {\n
      'tfOpName': 'Div',\n      'category': 'arithmetic',\n      'inputs': [\n        {'start': 0, 'name': 'a', 'type': 'tensor'},\n        {'start': 1,
name': 'b', 'type': 'tensor'},\n      ],\n      'attrs': [\n        {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n
      ]\n    }\n  ]\n];

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'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name':
'index', 'type': 'number'},\n {'start': 2, 'name': 'flowIn', 'type': 'number'},\n ],\n 'attrs': [{\n 'tfName':
'dtype',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n },\n {\n 'tfOpName':
'TensorArrayGatherV3',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorArrayId', 'type':
'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'number[]'},\n {'start': 2, 'name': 'flowIn', 'type': 'number'},\n
],\n 'attrs': [\n {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'},\n {'tfName': 'element_shape', 'name':
'elementShape', 'type': 'shape'}\n ]\n },\n {\n 'tfOpName': 'TensorArrayScatterV3',\n 'category': 'control',\n
'inputs': [\n {'start': 0, 'name': 'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type':
'number[]'},\n {'start': 2, 'name': 'tensor', 'type': 'tensor'},\n {'start': 3, 'name': 'flowIn', 'type': 'number'},\n
],\n 'attrs': [{\n 'tfName': 'T', 'name': 'dtype', 'type': 'dtype'}]\n },\n {\n 'tfOpName': 'TensorArrayConcatV3',\n
'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name':
'flowIn', 'type': 'number'},\n ],\n 'attrs': [\n {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'},\n {\n 'tfName':
'element_shape_except0',\n 'name': 'elementShapeExcept0',\n 'type': 'shape',\n 'notSupported': true\n
}]\n },\n {\n 'tfOpName': 'TensorArraySplitV3',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name':
'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name': 'tensor', 'type': 'tensor'},\n {'start': 2, 'name': 'lengths',
'type': 'number[]'},\n {'start': 3, 'name': 'flowIn', 'type': 'number'},\n ],\n 'attrs': [{\n 'tfName': 'T', 'name': 'dtype',
'type': 'dtype'}]\n },\n {\n 'tfOpName': 'TensorArraySizeV3',\n 'category': 'control',\n 'inputs': [\n {'start': 0,
'name': 'tensorArrayId', 'type': 'tensor'},\n {'start': 1, 'name': 'flowIn', 'type': 'number'}\n ]\n },\n {\n
'tfOpName': 'TensorArrayCloseV3',\n 'category': 'control',\n 'inputs': [{\n 'start': 0, 'name': 'tensorArrayId', 'type':
'tensor'}]\n },\n {\n 'tfOpName': 'StatelessIf',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'cond',
'type': 'tensor'},\n {'start': 1, 'end': 0, 'name': 'args', 'type': 'tensors'}\n ],\n 'attrs': [\n {'tfName':
'then_branch', 'name': 'thenBranch', 'type': 'func'},\n {'tfName': 'else_branch', 'name': 'elseBranch', 'type': 'func'}\n
],\n },\n {\n 'tfOpName': 'If',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'cond', 'type': 'tensor'},\n
{'start': 1, 'end': 0, 'name': 'args', 'type': 'tensors'}\n ],\n 'attrs': [\n {'tfName': 'then_branch', 'name':
'thenBranch', 'type': 'func'},\n {'tfName': 'else_branch', 'name': 'elseBranch', 'type': 'func'}\n ]\n },\n {\n
'tfOpName': 'StatelessWhile',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'end': 0, 'name': 'args', 'type':
'tensors'},\n ],\n 'attrs': [\n {'tfName': 'cond', 'name': 'cond', 'type': 'func'},\n {'tfName': 'body', 'name':
'body', 'type': 'func'}\n ]\n },\n {\n 'tfOpName': 'While',\n 'category': 'control',\n 'inputs': [\n {'start': 0,
'end': 0, 'name': 'args', 'type': 'tensors'},\n ],\n 'attrs': [\n {'tfName': 'cond', 'name': 'cond', 'type': 'func'},\n
{'tfName': 'body', 'name': 'body', 'type': 'func'}\n ]\n },\n {\n 'tfOpName': 'TensorListScatter',\n 'category':
'control',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type':
'number[]'},\n {'start': 2, 'name': 'elementShape', 'type': 'shape'}\n ],\n 'attrs':\n [{\n 'tfName':
'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n 'tfOpName': 'TensorListScatterV2',\n
'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n {'start': 1, 'name': 'indices',
'type': 'number[]'},\n {'start': 2, 'name': 'elementShape', 'type': 'shape'},\n {'start': 3, 'name': 'numElements',
'type': 'number'},\n ],\n 'attrs':\n [{\n 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n
{\n 'tfOpName': 'TensorListGather',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorListId',
'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'number[]'},\n {'start': 2, 'name': 'elementShape', 'type':
'shape'},\n ],\n 'attrs':\n [{\n 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n
'tfOpName': 'TensorListGetItem',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorListId', 'type':
'tensor'},\n {'start': 1, 'name': 'index', 'type': 'number'},\n {'start': 2, 'name': 'elementShape', 'type': 'shape'},\n
],\n 'attrs':\n [{\n 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n 'tfOpName':
'TensorListSetItem',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'tensorListId', 'type': 'tensor'},\n
{'start': 1, 'name': 'index', 'type': 'number'},\n {'start': 2, 'name': 'tensor', 'type': 'tensor'},\n ],\n 'attrs':\n
[{\n 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n 'tfOpName':
'TensorListReserve',\n 'category': 'control',\n 'inputs': [\n {'start': 0, 'name': 'elementShape', 'type': 'shape'},\n
{'start': 1, 'name': 'numElements', 'type': 'number'},\n ],\n 'attrs':\n [{\n 'tfName': 'element_dtype', 'name':
'elementDType', 'type': 'dtype'}]\n },\n {\n 'tfOpName': 'TensorListFromTensor',\n 'category': 'control',\n

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'inputs': [\n  {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n  {'start': 1, 'name': 'elementShape', 'type': 'shape'}\n ],\n 'attrs':\n  [{ 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n  'tfOpName': 'TensorListStack',\n  'category': 'control',\n  'inputs': [\n    {'start': 0, 'name': 'tensorListId', 'type': 'tensor'},\n    {'start': 1, 'name': 'elementShape', 'type': 'shape'},\n    ],\n  'attrs': [\n    {'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'},\n    {'tfName': 'num_elements', 'name': 'numElements', 'type': 'dtype'}\n  ]\n },\n {\n  'tfOpName': 'TensorListSplit',\n  'category': 'control',\n  'inputs': [\n    {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n    {'start': 1, 'name': 'elementShape', 'type': 'shape'},\n    {'start': 2, 'name': 'lengths', 'type': 'number[]'}\n  ],\n  'attrs':\n    [{ 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n  'tfOpName': 'TensorListConcat',\n  'category': 'control',\n  'inputs': [\n    {'start': 0, 'name': 'tensorListId', 'type': 'tensor'},\n    ],\n  'attrs': [\n    {'tfName': 'element_shape', 'name': 'elementShape', 'type': 'shape'},\n    {'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}\n  ]\n },\n {\n  'tfOpName': 'TensorListPopBack',\n  'category': 'control',\n  'inputs': [\n    {'start': 0, 'name': 'tensorListId', 'type': 'tensor'},\n    {'start': 1, 'name': 'elementShape', 'type': 'shape'},\n    ],\n  'attrs':\n    [{ 'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}]\n },\n {\n  'tfOpName': 'TensorListPushBack',\n  'category': 'control',\n  'inputs': [\n    {'start': 0, 'name': 'tensorListId', 'type': 'tensor'},\n    {'start': 1, 'name': 'tensor', 'type': 'tensor'},\n    ],\n  'attrs': [\n    {'tfName': 'element_dtype', 'name': 'elementDType', 'type': 'dtype'}\n  ]\n }];\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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*/\n\nimport {OpMapper} from './types';\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'AvgPool',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'},\n      {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string', 'notSupported': true},\n      {'tfName': 'ksize', 'name': 'kernelSize', 'type': 'number[]'},\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'MaxPool',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'},\n      {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string', 'notSupported': true},\n      {'tfName': 'ksize', 'name': 'kernelSize', 'type': 'number[]'},\n      {'tfName': 'explicit_paddings', 'name': 'explicitPaddings', 'type': 'number[]', 'defaultValue': [], 'notSupported': true},\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'MaxPoolWithArgmax',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'},\n      {'tfName': 'ksize', 'name': 'kernelSize', 'type': 'number[]'},\n      {'tfName': 'include_batch_in_index', 'name': 'includeBatchInIndex', 'type': 'bool'},\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'AvgPool3D',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'},\n      {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string', 'notSupported': true},\n      {'tfName': 'ksize', 'name': 'kernelSize', 'type': 'number[]'},\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'MaxPool3D',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'},\n      {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string', 'notSupported': true},\n      {'tfName': 'ksize', 'name': 'kernelSize', 'type': 'number[]'},\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'Conv1D',\n
```



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'defaultValue': [1, 1, 1, 1]\n    },\n    {\n      'tfName': 'fused_ops',\n      'name': 'fusedOps',\n      'type': 'string[]',\n      'defaultValue': []\n    },\n    {\n      'tfName': 'explicit_paddings',\n      'name': 'explicitPaddings',\n      'type': 'number[]',\n      'defaultValue': []\n    }\n  ],\n  {\n    'tfOpName': 'Conv3D',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      {'start': 1, 'name': 'filter', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'},\n      {'tfName': 'data_format', 'name': 'dataFormat', 'type': 'string'},\n      {'tfName': 'dilations', 'name': 'dilations', 'type': 'number[]'}\n    ]\n  },\n  {\n    'tfOpName': 'Dilation2D',\n    'category': 'convolution',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      {'start': 1, 'name': 'filter', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'strides', 'name': 'strides', 'type': 'number[]'},\n      {'tfName': 'rates', 'name': 'dilations', 'type': 'number[]'},\n      {'tfName': 'padding', 'name': 'pad', 'type': 'string'}\n    ]\n  }\n];\n\n",import {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====\n\n*/\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'Fill',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'shape', 'type': 'number[]'},\n      {'start': 1, 'name': 'value', 'type': 'number'},\n    ],\n    'attrs': [\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'LinSpace',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'start', 'type': 'number'},\n      {'start': 1, 'name': 'stop', 'type': 'number'},\n      {'start': 2, 'name': 'num', 'type': 'number'},\n    ],\n    'attrs': [\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'OneHot',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'indices', 'type': 'tensor'},\n      {'start': 1, 'name': 'depth', 'type': 'number'},\n      {'start': 2, 'name': 'onValue', 'type': 'number', 'defaultValue': 1},\n      {'start': 3, 'name': 'offValue', 'type': 'number', 'defaultValue': 0},\n    ],\n    'attrs': [\n      {'tfName': 'axis', 'name': 'axis', 'type': 'number', 'notSupported': true},\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'Ones',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'shape', 'type': 'number[]'},\n    ],\n    'attrs': [\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'OnesLike',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'RandomUniform',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'shape', 'type': 'number[]'},\n    ],\n    'attrs': [\n      {'tfName': 'minval', 'name': 'minval', 'type': 'number', 'defaultValue': 0},\n      {'tfName': 'maxval', 'name': 'maxval', 'type': 'number', 'defaultValue': 1},\n      {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'},\n      {'tfName': 'seed', 'name': 'seed', 'type': 'number', 'defaultValue': 0},\n      {'tfName': 'seed2', 'name': 'seed2', 'type': 'number', 'defaultValue': 0, 'notSupported': true},\n      {'tfName': 'T', 'name': 'T', 'type': 'number', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'Range',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'start', 'type': 'number'},\n      {'start': 1, 'name': 'stop', 'type': 'number'},\n      {'start': 2, 'name': 'step', 'type': 'number', 'defaultValue': 0},\n    ],\n    'attrs': [\n      {'tfName': 'Tidx', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'TruncatedNormal',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'shape', 'type': 'number[]'},\n    ],\n    'attrs': [\n      {'tfName': 'means', 'name': 'mean', 'type': 'number', 'defaultValue': 0.0},\n      {'tfName': 'stddev', 'name': 'stdDev', 'type': 'number', 'defaultValue': 1.0},\n      {'tfName': 'seed', 'name': 'seed', 'type': 'number'},\n      {'tfName': 'seed2', 'name': 'seed2', 'type': 'number', 'defaultValue': 0, 'notSupported': true},\n      {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'},\n      {'tfName': 'T', 'name': 'T', 'type': 'number', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'Zeros',\n    'category': 'creation',\n    'inputs': [\n      {'start': 0, 'name': 'shape', 'type': 'number[]'},\n    ],\n    'attrs': [\n      {'tfName': 'T', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'ZerosLike',\n    'category': 'creation',\n
```


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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n*\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'PlaceholderWithDefault',\n    'category': 'graph',\n    'inputs': [\n      {'start': 0, 'name': 'default', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'shape', 'name': 'shape', 'type': 'shape'},\n      {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'Placeholder',\n    'category': 'graph',\n    'attrs': [\n      {'tfName': 'shape', 'name': 'shape', 'type': 'shape'},\n      {'tfName': 'dtype', 'name': 'dtype', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'Const', 'category': 'graph',\n    {\n    'tfOpName': 'Identity',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'name': 'x', 'type': 'tensor' }]\n  },\n  {\n    'tfOpName': 'IdentityN',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'end': 0, 'name': 'x', 'type': 'tensors' }]\n  },\n  {\n    'tfOpName': 'Snapshot',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'name': 'x', 'type': 'tensor' }]\n  },\n  {\n    'tfOpName': 'Rank',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'name': 'x', 'type': 'tensor' }]\n  },\n  {\n    'tfOpName': 'Size',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'name': 'x', 'type': 'tensor' }]\n  },\n  {\n    'tfOpName': 'Shape',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'name': 'x', 'type': 'tensor' }]\n  },\n  {\n    'tfOpName': 'ShapeN',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'end': 0, 'name': 'x', 'type': 'tensors' }]\n  },\n  {\n    'tfOpName': 'Print',\n    'category': 'graph',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      {'start': 1, 'name': 'data', 'type': 'tensors'},\n    ],\n    'attrs': [\n      {'tfName': 'message', 'name': 'message', 'type': 'string'},\n      {'tfName': 'first_n', 'name': 'firstN', 'type': 'number', 'notSupported': true},\n      {'tfName': 'summarize', 'name': 'summarize', 'type': 'number', 'defaultValue': 3}\n    ]\n  },\n  {\n    'tfOpName': 'NoOp',\n    'category': 'graph',\n    'inputs': []\n  },\n  {\n    'tfOpName': 'StopGradient',\n    'category': 'graph',\n    'inputs': [{ 'start': 0, 'name': 'x', 'type': 'tensor' }]\n  },\n  {\n    'tfOpName': 'FakeQuantWithMinMaxVars',\n    'category': 'graph',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {'tfName': 'min', 'name': 'min', 'type': 'number'},\n      {'tfName': 'max', 'name': 'max', 'type': 'number'}\n    ]\n  }\n];\n\n**\n * @license\n * Copyright  
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {OpMapper} from './types';\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'HashTable',\n    'category': 'hash_table',\n    'inputs': [],\n    'attrs': [\n      {'tfName': 'shared_name', 'name': 'sharedName', 'type': 'string'},\n      {'tfName': 'use_node_name_sharing', 'name': 'useNodeNameSharing', 'type': 'bool'},\n      {'tfName': 'key_dtype', 'name': 'keyDType', 'type': 'dtype'},\n      {'tfName': 'value_dtype', 'name': 'valueDType', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'HashTableV2',\n    'category': 'hash_table',\n    'inputs': [],\n    'attrs': [\n      {'tfName': 'shared_name', 'name': 'sharedName', 'type': 'string'},\n      {'tfName': 'use_node_name_sharing', 'name': 'useNodeNameSharing', 'type': 'bool'},\n      {'tfName': 'key_dtype', 'name': 'keyDType', 'type': 'dtype'},\n      {'tfName': 'value_dtype', 'name': 'valueDType', 'type': 'dtype'}\n    ]\n  },\n  {\n    'tfOpName': 'LookupTableImport',\n    'category': 'hash_table',\n    'inputs': [\n      {'start': 0, 'name': 'tableHandle', 'type': 'tensor'},\n      {'start': 1, 'name': 'keys', 'type': 'tensor'},\n      {'start': 2, 'name': 'values', 'type': 'tensor'}\n    ],\n    'attrs': [\n      {'tfName': 'Tin', 'name': 'tIn', 'type': 'dtype', 'notSupported': true},\n      {'tfName': 'Tout', 'name': 'tOut', 'type': 'dtype', 'notSupported': true}\n    ]\n  },\n  {\n    'tfOpName': 'LookupTableImportV2',\n    'category': 'hash_table',\n    'inputs': [\n      {'start': 0, 'name': 'tableHandle', 'type': 'tensor'},\n      {'start': 1, 'name': 'keys', 'type': 'tensor'},\n      {'start': 2, 'name': 'values', 'type': 'tensor'}\n    ],\n    'attrs': [\n      {'tfName': 'Tin', 'name': 'tIn', 'type': 'dtype', 'notSupported': true},\n      {'tfName': 'Tout', 'name': 'tOut', 'type': 'dtype', 'notSupported': true}\n    ]\n  }\n];
```



```
'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n {\n 'tfOpName': 'LogicalAnd',\n 'category': 'logical',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n {\n 'tfOpName': 'LogicalNot',\n 'category': 'logical',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n ],\n 'attrs': [\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n {\n 'tfOpName': 'LogicalOr',\n 'category': 'logical',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n {\n 'tfOpName': 'Select',\n 'category': 'logical',\n 'inputs': [\n  {'start': 0, 'name': 'condition', 'type': 'tensor'},\n  {'start': 1, 'name': 'a', 'type': 'tensor'},\n  {'start': 2, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n {\n 'tfOpName': 'SelectV2',\n 'category': 'logical',\n 'inputs': [\n  {'start': 0, 'name': 'condition', 'type': 'tensor'},\n  {'start': 1, 'name': 'a', 'type': 'tensor'},\n  {'start': 2, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [{\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n }];\n";\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*/\n\nimport {OpMapper} from '../types';\n\nexport const json: OpMapper[] = [\n  {\n 'tfOpName': '_FusedMatMul',\n 'category': 'matrices',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n  {'start': 2, end: 0, 'name': 'args', 'type': 'tensors'},\n ],\n 'attrs': [\n  {'tfName': 'num_args', 'name': 'numArgs', 'type': 'number'},\n  {\n 'tfName': 'fused_ops',\n 'name': 'fusedOps',\n 'type': 'string[]',\n 'defaultValue': []\n },\n  {\n 'tfName': 'epsilon',\n 'name': 'epsilon',\n 'type': 'number',\n 'defaultValue': 0.0001\n },\n  {\n 'tfName': 'transpose_a',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {\n 'tfName': 'transpose_b',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n  {\n 'tfOpName': 'MatMul',\n 'category': 'matrices',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {\n 'tfName': 'transpose_a',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {\n 'tfName': 'transpose_b',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n  {\n 'tfOpName': 'BatchMatMul',\n 'category': 'matrices',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {\n 'tfName': 'adj_x',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {\n 'tfName': 'adj_y',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n  {\n 'tfOpName': 'BatchMatMulV2',\n 'category': 'matrices',\n 'inputs': [\n  {'start': 0, 'name': 'a', 'type': 'tensor'},\n  {'start': 1, 'name': 'b', 'type': 'tensor'},\n ],\n 'attrs': [\n  {\n 'tfName': 'adj_x',\n 'name': 'transposeA',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {\n 'tfName': 'adj_y',\n 'name': 'transposeB',\n 'type': 'bool',\n 'defaultValue': false\n },\n  {'tfName': 'T', 'name': 'dtype', 'type': 'dtype', 'notSupported': true}\n ]\n },\n  {\n 'tfOpName': 'Transpose',\n 'category': 'matrices',\n 'inputs': [\n  {'start': 0, 'name': 'x', 'type': 'tensor'},\n  {'start': 1, 'name': 'perm', 'type': 'number[]'},\n ],\n 'attrs': [{\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n }];\n";\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'FusedBatchNorm',\n    'category': 'normalization',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      {'start': 1, 'name': 'scale', 'type': 'tensor'},\n      {'start': 2, 'name': 'offset', 'type': 'tensor'},\n      {'start': 3, 'name': 'mean', 'type': 'tensor'},\n      {'start': 4, 'name': 'variance', 'type': 'tensor'},\n    ],\n    'attrs': [\n      {\n        'tfName': 'epsilon',\n        'name': 'epsilon',\n        'type': 'number',\n        'defaultValue': 0.001\n      },\n      {\n        'tfName': 'data_format',\n        'name': 'dataFormat',\n        'type': 'string',\n        'notSupported': true\n      }\n    ],\n    {\n      'tfOpName': 'FusedBatchNormV2',\n      'category': 'normalization',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n        {'start': 1, 'name': 'scale', 'type': 'tensor'},\n        {'start': 2, 'name': 'offset', 'type': 'tensor'},\n        {'start': 3, 'name': 'mean', 'type': 'tensor'},\n        {'start': 4, 'name': 'variance', 'type': 'tensor'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'epsilon',\n          'name': 'epsilon',\n          'type': 'number',\n          'defaultValue': 0.001\n        },\n        {\n          'tfName': 'data_format',\n          'name': 'dataFormat',\n          'type': 'string',\n          'notSupported': true\n        }\n      ],\n    },\n    {\n      'tfOpName': 'FusedBatchNormV3',\n      'category': 'normalization',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n        {'start': 1, 'name': 'scale', 'type': 'tensor'},\n        {'start': 2, 'name': 'offset', 'type': 'tensor'},\n        {'start': 3, 'name': 'mean', 'type': 'tensor'},\n        {'start': 4, 'name': 'variance', 'type': 'tensor'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'epsilon',\n          'name': 'epsilon',\n          'type': 'number',\n          'defaultValue': 0.001\n        },\n        {\n          'tfName': 'data_format',\n          'name': 'dataFormat',\n          'type': 'string',\n          'notSupported': true\n        }\n      ],\n    },\n    {\n      'tfOpName': 'LRN',\n      'category': 'normalization',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'depth_radius',\n          'name': 'radius',\n          'type': 'number',\n          'defaultValue': 5\n        },\n        {\n          'tfName': 'bias',\n          'name': 'bias',\n          'type': 'number',\n          'defaultValue': 1.0\n        },\n        {\n          'tfName': 'alpha',\n          'name': 'alpha',\n          'type': 'number',\n          'defaultValue': 1.0\n        },\n        {\n          'tfName': 'beta',\n          'name': 'beta',\n          'type': 'number',\n          'defaultValue': 0.5\n        }\n      ],\n    },\n    {\n      'tfOpName': 'Softmax',\n      'category': 'normalization',\n      'inputs': [{\n        'start': 0, 'name': 'x', 'type': 'tensor'\n      }]\n    },\n    {\n      'tfOpName': 'LogSoftmax',\n      'category': 'normalization',\n      'inputs': [{\n        'start': 0, 'name': 'x', 'type': 'tensor'\n      }]\n    },\n    {\n      'tfOpName': 'SparseToDense',\n      'category': 'normalization',\n      'inputs': [\n        {'start': 0, 'name': 'sparseIndices', 'type': 'tensor'},\n        {'start': 1, 'name': 'outputShape', 'type': 'number[]'},\n        {'start': 2, 'name': 'sparseValues', 'type': 'tensor'},\n        {'start': 3, 'name': 'defaultValue', 'type': 'tensor'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'validate_indices',\n          'name': 'validateIndices',\n          'type': 'bool',\n          'defaultValue': true,\n          'notSupported': true\n        }\n      ]\n    }\n  ],\n];\n\n\"import {OpMapper} from '../types';\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nexport const json: OpMapper[] = [\n  {\n    'tfOpName': 'Bincount',\n    'category': 'reduction',\n    'inputs': [\n      {'start': 0, 'name': 'x', 'type': 'tensor'},\n      {'start': 1, 'name': 'size', 'type': 'number'},\n      {'start': 2, 'name': 'weights', 'type': 'tensor'}\n    ],\n    {\n      'tfOpName': 'DenseBincount',\n      'category': 'reduction',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n        {'start': 1, 'name': 'size', 'type': 'number'},\n        {'start': 2, 'name': 'weights', 'type': 'tensor'}\n      ],\n      'attrs': [\n        {\n          'tfName': 'binary_output',\n          'name': 'binaryOutput',\n          'type': 'bool'\n        }\n      ],\n    },\n    {\n      'tfOpName': 'Max',\n      'category': 'reduction',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n        {'start': 1, 'name': 'axis', 'type': 'number[]'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'keep_dims',\n          'name': 'keepDims',\n          'type': 'bool'\n        }\n      ],\n    },\n    {\n      'tfOpName': 'Mean',\n      'category': 'reduction',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n        {'start': 1, 'name': 'axis', 'type': 'number[]'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'keep_dims',\n          'name': 'keepDims',\n          'type': 'bool'\n        }\n      ],\n    },\n    {\n      'tfOpName': 'Min',\n      'category': 'reduction',\n      'inputs': [\n        {'start': 0, 'name': 'x', 'type': 'tensor'},\n        {'start': 1, 'name': 'axis', 'type': 'number[]'},\n      ],\n      'attrs': [\n        {\n          'tfName': 'keep_dims',\n          'name': 'keepDims',\n          'type': 'bool'\n        }\n      ],\n    },\n  ],\n];\n\n\"import {OpMapper} from '../types';\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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'tensor'},\n  {'start': 1, 'name': 'axis', 'type': 'number[]'},\n ],\n 'attrs': [{'tfName': 'keep_dims', 'name':  
'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Sum',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0,  
'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n ],\n 'attrs': [{'tfName': 'keep_dims',  
'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'All',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n ],\n 'attrs': [{'tfName':  
'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'Any',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'},\n ],\n 'attrs':  
[{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName': 'ArgMax',\n 'category':  
'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}]\n ]\n },\n {\n 'tfOpName': 'ArgMin',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type':  
'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}]\n },\n {\n 'tfOpName': 'Prod',\n 'category':  
'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type':  
'number[]'},\n ],\n 'attrs': [{'tfName': 'keep_dims', 'name': 'keepDims', 'type': 'bool'}]\n },\n {\n 'tfOpName':  
'Cumsum',\n 'category': 'reduction',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name':  
'axis', 'type': 'number'},\n ],\n 'attrs': [\n {'tfName': 'exclusive', 'name': 'exclusive', 'type': 'bool'},\n {'tfName': 'reverse', 'name': 'reverse', 'type': 'bool'}]\n ]\n };\n\n", "import {OpMapper} from './types';\n\n**\n *  
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a  
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *  
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n *  
=====
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\n *  
\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'ConcatV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': -1, 'name': 'tensors', 'type': 'tensors'},\n {'start': -1, 'name': 'axis', 'type': 'number'}]\n ],\n 'attrs':\n [{ 'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2 }]\n },\n {\n 'tfOpName': 'Concat',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 1, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n {'start': 0, 'name':  
'axis', 'type': 'number'}]\n ],\n 'attrs': [ { 'tfName': 'N', 'name': 'n', 'type': 'number', 'defaultValue': 2 } ]\n },\n {\n 'tfOpName': 'GatherV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'tensor'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n ],\n 'attrs': [ { 'tfName': 'batch_dims', 'name': 'batchDims', 'type': 'number', 'defaultValue': 0 } ]\n },\n {\n 'tfOpName': 'Gather',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'tensor'},\n ],\n 'attrs': [ { 'tfName': 'validate_indices', 'name':  
'validateIndices', 'type': 'bool', 'notSupported': true } ]\n },\n {\n 'tfOpName': 'Reverse',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'dims', 'type':  
'bool[]'}]\n },\n {\n 'tfOpName': 'ReverseV2',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name':  
'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number[]'}]\n },\n {\n 'tfOpName': 'Slice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'begin', 'type':  
'number[]'},\n {'start': 2, 'name': 'size', 'type': 'number[]'}]\n },\n {\n 'tfOpName': 'StridedSlice',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'begin', 'type':  
'number[]'},\n {'start': 2, 'name': 'end', 'type': 'number[]'},\n {'start': 3, 'name': 'strides', 'type': 'number[]'},\n ],\n 'attrs': [\n {\n 'tfName': 'begin_mask',\n 'name': 'beginMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'end_mask',\n 'name': 'endMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'new_axis_mask',\n 'name': 'newAxisMask',\n 'type':  
'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'ellipsis_mask',\n 'name': 'ellipsisMask',\n 'type': 'number',\n 'defaultValue': 0\n },\n {\n 'tfName': 'shrink_axis_mask',\n 'name':  
'shrinkAxisMask',\n 'type': 'number',\n 'defaultValue': 0\n }]\n },\n {\n 'tfOpName': 'Pack',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'end': 0, 'name': 'tensors', 'type': 'tensors'},\n ],\n 'attrs': [\n
```



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{'tfName': 'axis', 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n ]\n },\n {\n 'tfOpName': 'Unpack',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'tensor', 'type': 'tensor'},\n ],\n 'attrs': [\n {'tfName': 'axis', 'name': 'axis', 'type': 'number', 'defaultValue': 0}, {\n 'tfName': 'num',\n 'name': 'num',\n 'type': 'number',\n 'defaultValue': 0,\n 'notSupported': true\n }\n ]\n },\n {\n 'tfOpName': 'Tile',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'reps', 'type': 'number[]'}\n ]\n },\n {\n 'tfOpName': 'Split',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'axis', 'type': 'number', 'defaultValue': 0},\n {'start': 1, 'name': 'x', 'type': 'tensor'},\n ],\n 'attrs': [{\n 'tfName': 'num_split',\n 'name': 'numOrSizeSplits',\n 'type': 'number',\n 'defaultValue': 1\n }]\n },\n {\n 'tfOpName': 'SplitV',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'numOrSizeSplits', 'type': 'number[]'},\n {'start': 2, 'name': 'axis', 'type': 'number', 'defaultValue': 0}\n ]\n },\n {\n 'tfOpName': 'ScatterNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'indices', 'type': 'tensor'},\n {'start': 1, 'name': 'values', 'type': 'tensor'},\n {'start': 2, 'name': 'shape', 'type': 'number[]'}\n ]\n },\n {\n 'tfOpName': 'GatherNd',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'indices', 'type': 'tensor'}\n ]\n },\n {\n 'tfOpName': 'SparseToDense',\n 'category': 'slice_join',\n 'inputs': [\n {'start': 0, 'name': 'sparseIndices', 'type': 'tensor'},\n {'start': 1, 'name': 'outputShape', 'type': 'number[]'},\n {'start': 2, 'name': 'sparseValues', 'type': 'tensor'},\n {'start': 3, 'name': 'defaultValue', 'type': 'tensor'}\n ],\n 'attrs': [{\n 'tfName': 'validate_indices',\n 'name': 'validateIndices',\n 'type': 'bool',\n 'defaultValue': false,\n 'notSupported': true\n }]\n }]\n };\n\n","import {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====\n\n*/\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'FFT',\n 'category': 'spectral',\n 'inputs': [{\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'IFFT',\n 'category': 'spectral',\n 'inputs': [{\n 'start': 0, 'name': 'x',\n 'type': 'tensor'}]\n },\n {\n 'tfOpName': 'RFFT',\n 'category': 'spectral',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1,\n 'name': 'fft_length',\n 'type': 'number',\n 'notSupported': true\n }\n ]\n },\n {\n 'tfOpName': 'IRFFT',\n 'category': 'spectral',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1,\n 'name': 'fft_length',\n 'type': 'number',\n 'notSupported': true\n }\n ]\n }\n ];\n\n","import {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====\n\n*/\n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'Cast',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n ],\n 'attrs': [\n {\n 'tfName': 'SrcT',\n 'name': 'sdtype',\n 'type': 'dtype',\n 'notSupported': true\n },\n {\n 'tfName': 'DstT',\n 'name': 'dtype',\n 'type': 'dtype'}\n ]\n },\n {\n 'tfOpName': 'ExpandDims',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'axis', 'type': 'number'}\n ]\n },\n {\n 'tfOpName': 'MirrorPad',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'padding', 'type': 'number[]'},\n ],\n 'attrs': [{\n 'tfName': 'mode',\n 'name': 'mode',\n 'type': 'string'}]\n },\n {\n 'tfOpName': 'Pad',\n 'category': 'transformation',\n 'inputs': [\n {'start': 0, 'name': 'x', 'type': 'tensor'},\n {'start': 1, 'name': 'padding',
```



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{\n    weights.push(map[node.name]);\n    } else if (node.input == null || node.input.length === 0) {\n
initNodes.push(map[node.name]);\n    }\n    return map;\n    }, {});\n\n let inputs: Node[] = [];\n const outputs:
Node[] = [];\n let inputNodeNameToKey: {[key: string]: string} = {};\n let outputNodeNameToKey: {[key:
string]: string} = {};\n if (signature != null) {\n    inputNodeNameToKey =
this.mapSignatureEntries(signature.inputs);\n    outputNodeNameToKey =
this.mapSignatureEntries(signature.outputs);\n    }\n    const allNodes = Object.keys(nodes);\n
allNodes.forEach(key => {\n    const node = nodes[key];\n    node.inputNames.forEach(name => {\n    const
[nodeName, ] = getNodeNameAndIndex(name);\n    node.inputs.push(nodes[nodeName]);\n
nodes[nodeName].children.push(node);\n    });\n    });\n\n // if signature has not outputs set, add any node that
does not have\n // outputs.\n if (Object.keys(outputNodeNameToKey).length === 0) {\n
allNodes.forEach(key => {\n    const node = nodes[key];\n    if (node.children.length === 0) {\n
outputs.push(node);\n    }\n    });\n    } else {\n    Object.keys(outputNodeNameToKey).forEach(name => {\n
const [nodeName, ] = getNodeNameAndIndex(name);\n    const node = nodes[nodeName];\n    if (node !=
null) {\n    node.signatureKey = outputNodeNameToKey[name];\n    outputs.push(node);\n    }\n    });\n
}\n\n if (Object.keys(inputNodeNameToKey).length > 0) {\n
Object.keys(inputNodeNameToKey).forEach(name => {\n    const [nodeName, ] =
getNodeNameAndIndex(name);\n    const node = nodes[nodeName];\n    if (node) {\n    node.signatureKey
= inputNodeNameToKey[name];\n    inputs.push(node);\n    }\n    });\n    } else {\n    inputs =
placeholders;\n    }\n\n let functions = {};\n if (graph.library != null && graph.library.function != null) {\n
functions = graph.library.function.reduce((functions, func) => {\n    functions[func.signature.name] =
this.mapFunction(func);\n    return functions;\n    }, {} as {[key: string]: Graph});\n    }\n\n const result: Graph
=> {\n    {nodes, inputs, outputs, weights, placeholders, signature, functions};\n\n if (initNodes.length > 0) {\n
result.initNodes = initNodes;\n    }\n\n return result;\n    }\n\n private mapSignatureEntries(entries: {[k: string]:
tensorflow.ITensorInfo}) {\n    return Object.keys(entries || {}).reduce<{[key: string]: string}>((prev, curr)
=> {\n    prev[entries[curr].name] = curr;\n    return prev;\n    }, {});\n    }\n\n private mapNode(node:
tensorflow.INodeDef): Node {\n    // Unsupported ops will cause an error at run-time (not parse time), since\n //
they may not be used by the actual execution subgraph.\n    const mapper => getRegisteredOp(node.op) ||
this.opMappers[node.op] || {} as OpMapper;\n    if (node.attr == null) {\n    node.attr = {};\n    }\n\n const
newNode: Node = {\n    name: node.name,\n    op: node.op,\n    category: mapper.category,\n    inputNames:\n
(node.input || []).map(input => input.startsWith('^') ? input.substr(1) : input),\n    inputs: [],\n
children: [],\n    inputParams: {},\n    attrParams: {},\n    rawAttrs: node.attr\n    }; \n\n if (mapper.inputs !=
null) {\n    newNode.inputParams => mapper.inputs.reduce<{[key: string]: InputParamValue}>(\n
(map, param) => {\n    map[param.name] = {\n    type: param.type,\n    inputIndexStart:
param.start,\n    inputIndexEnd: param.end\n    };\n    return map;\n    },\n    {});\n    }\n\n if (mapper.attrs != null) {\n    newNode.attrParams => mapper.attrs.reduce<{[key: string]:
ParamValue}>((map, param) => {\n    const type = param.type;\n    let value = undefined;\n    switch
(param.type) {\n    case 'string':\n    value = getStringParam(\n    node.attr, param.tfName,
param.defaultValue as string);\n    if (value === undefined && !!param.tfDeprecatedName) {\n
value = getStringParam(\n    node.attr, param.tfDeprecatedName,\n    param.defaultValue as
string);\n    }\n    break;\n    case 'string[]':\n    value = getStringArrayParam(\n
node.attr, param.tfName, param.defaultValue as string[]);\n    if (value === undefined &&
!!param.tfDeprecatedName) {\n    value = getStringArrayParam(\n    node.attr,
param.tfDeprecatedName,\n    param.defaultValue as string[]);\n    }\n    break;\n    case 'number':\n    value = getNumberParam(\n    node.attr, param.tfName,\n
(param.defaultValue || 0) as number);\n    if (value === undefined && !!param.tfDeprecatedName) {\n
value = getNumberParam(\n    node.attr, param.tfDeprecatedName,\n
param.defaultValue as number);\n    }\n    break;\n    case 'number[]':\n    value =
getNumericArrayParam(\n    node.attr, param.tfName, param.defaultValue as number[]);\n    if

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(value === undefined && !param.tfDeprecatedName) {\n          value = getNumericArrayParam(\n
node.attr, param.tfDeprecatedName,\n          param.defaultValue as number[]);\n          }\n
break;\n      case 'bool':\n          value = getBoolParam(\n          node.attr, param.tfName,\n          param.defaultValue as boolean);\n          if (value === undefined && !param.tfDeprecatedName) {\n
value = getBoolParam(\n          node.attr, param.tfDeprecatedName,\n          param.defaultValue as\n          boolean);\n          }\n          break;\n      case 'bool[]':\n          value = getBoolArrayParam(\n          node.attr, param.tfName, param.defaultValue as boolean[]);\n          if (value === undefined &&\n          !param.tfDeprecatedName) {\n          value = getBoolArrayParam(\n          node.attr,\n          param.tfDeprecatedName,\n          param.defaultValue as boolean[]);\n          }\n          break;\n      case 'shape':\n          value = getTensorShapeParam(\n          node.attr, param.tfName, param.defaultValue\n          as number[]);\n          if (value === undefined && !param.tfDeprecatedName) {\n          value =\n          getTensorShapeParam(\n          node.attr, param.tfDeprecatedName,\n          param.defaultValue as\n          number[]);\n          }\n          break;\n      case 'shape[]':\n          value =\n          getTensorShapeArrayParam(\n          node.attr, param.tfName, param.defaultValue as number[][]);\n          if (value === undefined && !param.tfDeprecatedName) {\n          value = getTensorShapeArrayParam(\n          node.attr, param.tfDeprecatedName,\n          param.defaultValue as number[][]);\n          }\n          break;\n      case 'dtype':\n          value = getDtypeParam(\n          node.attr, param.tfName,\n          param.defaultValue as DataType);\n          if (value === undefined && !param.tfDeprecatedName) {\n
value = getDtypeParam(\n          node.attr, param.tfDeprecatedName,\n          param.defaultValue as\n          DataType);\n          }\n          break;\n      case 'dtype[]':\n          value = getDtypeArrayParam(\n          node.attr, param.tfName, param.defaultValue as DataType[]);\n          if (value === undefined &&\n          !param.tfDeprecatedName) {\n          value = getDtypeArrayParam(\n          node.attr,\n          param.tfDeprecatedName,\n          param.defaultValue as DataType[]);\n          }\n          break;\n      case 'func':\n          value = getFuncParam(\n          node.attr, param.tfName, param.defaultValue as\n          string);\n          if (value === undefined && !param.tfDeprecatedName) {\n          value = getFuncParam(\n          node.attr, param.tfDeprecatedName,\n          param.defaultValue as string);\n          }\n          break;\n      case 'tensor':\n      case 'tensors':\n          break;\n      default:\n          throw new\n          Error(\n          `Unsupported param type: ${param.type} for op: ${node.op}`);\n          }\n
map[param.name] = {value, type};\n      return map;\n      }, {});\n      }\n      return newNode;\n      }\n      // map\n      the TFunctionDef to TFJS graph object\n      private mapFunction(functionDef: tensorflow.IFunctionDef): Graph {\n
const tfNodes = functionDef.nodeDef;\n      const placeholders: Node[] = [];\n      const weights: Node[] = [];\n      let\n      nodes: {[key: string]: Node} = {};\n      if (tfNodes !== null) {\n      nodes = tfNodes.reduce<{[key: string]:\n      Node}>((map, node) => {\n      map[node.name] = this.mapNode(node);\n      if (node.op === 'Const') {\n
weights.push(map[node.name]);\n      }\n      return map;\n      }, {});\n      }\n      const inputs: Node[] = [];\n      const\n      outputs: Node[] = [];\n      functionDef.signature.inputArg.forEach(arg => {\n      const [nodeName, ] =\n      getNodeNameAndIndex(arg.name);\n      const node: Node = {\n      name: nodeName,\n      op: 'Placeholder',\n      inputs: [],\n      inputNames: [],\n      category: 'graph',\n      inputParams: {},\n      attrParams: {dtype: {value:\n      parseDtypeParam(arg.type), type: 'dtype'}},\n      children: []\n      };\n      node.signatureKey = arg.name;\n      inputs.push(node);\n      nodes[nodeName] = node;\n      });\n      const allNodes = Object.keys(nodes);\n      allNodes.forEach(key => {\n      const node = nodes[key];\n      node.inputNames.forEach(name => {\n      const\n      [nodeName, ] = getNodeNameAndIndex(name);\n      node.inputs.push(nodes[nodeName]);\n      nodes[nodeName].children.push(node);\n      });\n      });\n      const returnNodeMap = functionDef.ret;\n      functionDef.signature.outputArg.forEach(output => {\n      const [nodeName, index] =\n      getNodeNameAndIndex(returnNodeMap[output.name]);\n      const node = nodes[nodeName];\n      if (node !== null)\n      {\n      node.defaultOutput = index;\n      outputs.push(node);\n      }\n      });\n      const signature =\n      this.mapArgsToSignature(functionDef);\n      return {nodes, inputs, outputs, weights, placeholders, signature};\n      }\n      }\n      private mapArgsToSignature(functionDef: tensorflow.IFunctionDef):\n      tensorflow.ISignatureDef {\n      return {\n      methodName: functionDef.signature.name,\n      inputs: functionDef.signature.inputArg.reduce(\n

```



```

param.list.shape) {\n  return param.list.shape.map((v) => {\n    return parseTensorShapeParam(v);\n  });\n }\n
return def;\n}\n\nexport function getBoolArrayParam(\n  attrs: {[key: string]: tensorflow.IAttrValue}, name:
string,\n  def: boolean[]): boolean[] {\n  const param = attrs[name];\n  if (param && param.list && param.list.b)
{\n    return param.list.b;\n  }\n  return def;\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {DataType, Tensor} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {getTensor} from
'../executors/utils';\nimport {getBoolArrayParam, getBoolParam, getDtypeArrayParam, getDtypeParam,
getNumberParam, getNumericArrayParam, getStringArrayParam, getStringParam, getTensorShapeArrayParam,
getTensorShapeParam} from './operation_mapper';\nimport {GraphNode, Node, ValueType} from
'./types';\n\n/**\n * Helper class for lookup inputs and params for nodes in the model graph.\n */\nexport class
NodeValueImpl implements GraphNode {\n  public readonly inputs: Tensor[] = [];\n  public readonly attrs: {[key:
string]: ValueType} = {};\n  constructor(\n    private node: Node, private tensorMap: NamedTensorsMap,\n    private context: ExecutionContext) {\n    this.inputs = node.inputNames.map(name => this.getInput(name));\n    if
(node.rawAttrs != null) {\n      this.attrs = Object.keys(node.rawAttrs)\n        .reduce((attrs: {[key: string]:
ValueType}, key) => {\n          attrs[key] = this.getAttr(key);\n          return attrs;\n        }, {});\n    }\n  }\n\n  /**\n   * Return the value of the attribute or input param.\n   * @param name String: name of
attribute or input param.\n   */\n  private getInput(name: string): Tensor {\n    return getTensor(name,
this.tensorMap, this.context);\n  }\n\n  /**\n   * Return the value of the attribute or input param.\n   * @param name
String: name of attribute or input param.\n   */\n  private getAttr(name: string, defaultValue?: ValueType):
ValueType {\n    const value = this.node.rawAttrs[name];\n    if (value.tensor != null) {\n      return getTensor(name,
this.tensorMap, this.context);\n    }\n    if (value.i != null || value.f != null) {\n      return
getNumberParam(this.node.rawAttrs, name, defaultValue as number);\n    }\n    if (value.s != null) {\n      return
getStringParam(this.node.rawAttrs, name, defaultValue as string);\n    }\n    if (value.b != null) {\n      return
getBoolParam(this.node.rawAttrs, name, defaultValue as boolean);\n    }\n    if (value.shape != null) {\n      return
getTensorShapeParam(\n        this.node.rawAttrs, name, defaultValue as number[]);\n    }\n    if (value.type != null)
{\n      return getDtypeParam(this.node.rawAttrs, name, defaultValue as DataType);\n    }\n    if (value.list != null)
{\n      if (value.list.i != null || value.list.f != null) {\n        return getNumericArrayParam(\n
this.node.rawAttrs, name, defaultValue as number[]);\n      }\n      if (value.list.s != null) {\n        return
getStringArrayParam(\n          this.node.rawAttrs, name, defaultValue as string[]);\n      }\n      if (value.list.shape
!= null) {\n        return getTensorShapeArrayParam(\n          this.node.rawAttrs, name, defaultValue as
number[][]);\n      }\n      if (value.list.b != null) {\n        return getBoolArrayParam(\n          this.node.rawAttrs,
name, defaultValue as boolean[]);\n      }\n      if (value.list.type != null) {\n        return getDtypeArrayParam(\n
this.node.rawAttrs, name, defaultValue as DataType[]);\n      }\n    }\n    return defaultValue;\n  }\n}\n\n"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\n/**\n * This file exports ops used by the converters executors. By default it\n * re-exports all ops. In a custom

```

build this is aliased to a file that will only exports ops for a given model.json.
/* only exports ops for a given model.json.
*/
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distributed under the License is distributed on an "AS IS"
BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License.

```
=====  
import {Tensor} from '@tensorflow/tfjs-core';  
// tslint:disable-next-line: no-imports-from-dist  
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';  
import {NamedTensorsMap} from '../data/types';  
import {ExecutionContext} from '../executor/execution_context';  
import {InternalOpExecutor, Node} from '../types';  
import {getParamValue} from './utils';  
export const executeOp: InternalOpExecutor =  
(node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Tensor[] => {  
  switch (node.op) {  
    case 'BiasAdd':  
    case 'AddV2':  
    case 'Add':  
      return [tfOps.add(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'AddN':  
      return [tfOps.addN(  
        getParamValue('tensors', node, tensorMap, context) as Tensor[])];  
    case 'FloorMod':  
    case 'Mod':  
      return [tfOps.mod(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'Mul':  
      return [tfOps.mul(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'RealDiv':  
    case 'Div':  
      return [tfOps.div(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'DivNoNaN':  
      return [tfOps.divNoNaN(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'FloorDiv':  
      return [tfOps.floorDiv(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'Sub':  
      return [tfOps.sub(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'Minimum':  
      return [tfOps.minimum(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'Maximum':  
      return [tfOps.maximum(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'Pow':  
      return [tfOps.pow(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    case 'SquaredDifference':  
      return [tfOps.squaredDifference(  
        getParamValue('a', node, tensorMap, context) as Tensor,  
        getParamValue('b', node, tensorMap, context) as Tensor)];  
    default:  
      throw TypeError(`Node type ${node.op} is not implemented`);  
  }  
};  
export const CATEGORY = 'arithmetic';  
/*  
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BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
See the License for the specific language governing permissions and  
limitations under the License.
```

```
=====  
import {Tensor} from '@tensorflow/tfjs-core';  
// tslint:disable-next-line: no-imports-from-dist  
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';  
import {NamedTensorsMap} from '../data/types';  
import {ExecutionContext} from '../executor/execution_context';  
import {InternalOpExecutor, Node} from '../types';  
import {getParamValue, getTensor} from './utils';  
export const executeOp: InternalOpExecutor =  
(node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Tensor[]
```

```

=> {\n  switch (node.op) {\n    case 'Abs':\n      return [tfOps.abs(\n        getParamValue('x', node, tensorMap, context) as Tensor)];\n    case 'Acos':\n      return [tfOps.acos(\n        getParamValue('x', node, tensorMap, context) as Tensor)];\n    case 'Acosh':\n      return [tfOps.acosh(\n        getParamValue('x', node, tensorMap, context) as Tensor)];\n    case 'Asin':\n      return [tfOps.asin(\n        getParamValue('x', node, tensorMap, context) as Tensor)];\n    case 'Asinh':\n      return [tfOps.asinh(\n        getParamValue('x', node, tensorMap, context) as Tensor)];\n    case 'Atan':\n      return [tfOps.atan(\n        getParamValue('x', node, tensorMap, context) as Tensor)];\n    case 'Atan2':\n      return [tfOps.atan2(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor, \n        getParamValue('y', node, tensorMap, context) as\n        Tensor)];\n    case 'Atanh':\n      return [tfOps.atanh(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Ceil':\n      return [tfOps.ceil(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Complex':\n      return [tfOps.complex(\n        getParamValue('real', node, tensorMap,\n        context) as Tensor, \n        getParamValue('imag', node, tensorMap, context) as\n        Tensor)];\n    case 'Cos':\n      return [tfOps.cos(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Cosh':\n      return [tfOps.cosh(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Elu':\n      return [tfOps.elu(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Erf':\n      return [tfOps.erf(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Exp':\n      return [tfOps.exp(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Expml': {\n      return [tfOps.expml(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case\n    'Floor':\n      return [tfOps.floor(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case\n    'Log':\n      return [tfOps.log(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case\n    'Log1p': {\n      return [tfOps.log1p(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case 'Imag':\n      return [tfOps.imag(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Neg':\n      return [tfOps.neg(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Reciprocal': {\n      return [tfOps.reciprocal(\n        getParamValue('x', node, tensorMap,\n        context) as Tensor)];\n    } \n    case 'Real':\n      return [tfOps.real(\n        getParamValue('x', node,\n        tensorMap, context) as Tensor)];\n    case 'Relu':\n      return [tfOps.relu(\n        getParamValue('x', node,\n        tensorMap, context) as Tensor)];\n    case 'Round': {\n      return [tfOps.round(\n        getParamValue('x',\n        node, tensorMap, context) as Tensor)];\n    } \n    case 'Selu':\n      return [tfOps.selu(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Sigmoid':\n      return [tfOps.sigmoid(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Sin':\n      return [tfOps.sin(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case 'Sign': {\n      return [tfOps.sign(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case 'Sinh': {\n      return [tfOps.sinh(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case 'Softplus': {\n      return\n      [tfOps.softplus(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case 'Sqrt': {\n      return [tfOps.sqrt(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case\n    'Square': {\n      return [tfOps.square(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case 'Tanh': {\n      return [tfOps.tanh(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    } \n    case 'Tan':\n      return [tfOps.tan(\n        getParamValue('x', node, tensorMap,\n        context) as Tensor)];\n    case 'ClipByValue':\n      return [tfOps.clipByValue(\n        getParamValue('x',\n        node, tensorMap, context) as Tensor, \n        getParamValue('clipValueMin', node, tensorMap,\n        context) as\n        number, \n        getParamValue('clipValueMax', node, tensorMap,\n        context) as\n        number)];\n    case\n    'Relu6':\n      return [tfOps.relu6(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor)];\n    case\n    'Rsqrt':\n      return [tfOps.rsqrt(\n        getTensor(node.inputNames[0], tensorMap, context))];\n    case\n    'Prod':\n      return [tfOps.prod(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor, \n        getParamValue('axes', node, tensorMap, context) as\n        number[])];\n    case 'LeakyRelu':\n      return\n      [tfOps.leakyRelu(\n        getParamValue('x', node, tensorMap, context) as\n        Tensor, \n        getParamValue('alpha', node, tensorMap, context) as\n        number)];\n    case 'Prelu':\n      return [tfOps.prelu(\n        getParamValue('x', node, tensorMap, \n        getParamValue('alpha', node, tensorMap,

```



```

context) as Tensor]);\n      default:\n        throw TypeError(`Node type ${node.op} is not implemented`);\n      }\n    };\n\nexport const CATEGORY = 'basic_math';\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * =====\n *\n * This differs from util.assertShapesMatch in that it allows values of\n * negative one, an undefined size of a dimension, in a shape to match\n * anything.\n *\n */\nimport {Tensor, util} from '@tensorflow/tfjs-core';\n\n/**\n * Used by TensorList and TensorArray to verify if elementShape matches, support\n * negative value as the dim shape.\n *\n * @param shapeA\n * @param shapeB\n * @param errorMessagePrefix\n */\nexport function\nassertShapesMatchAllowUndefinedSize(\n  shapeA: number|number[], shapeB: number|number[],\n  errorMessagePrefix = "): void {\n  // constant shape means unknown rank\n  if (typeof shapeA === 'number' || typeof\n  shapeB === 'number') {\n    return;\n  }\n  util.assert(\n    shapeA.length === shapeB.length,\n    () =>\n    errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);\n  for (let i = 0; i < shapeA.length; i++) {\n    const dim0 = shapeA[i];\n    const dim1 = shapeB[i];\n    util.assert(\n      dim0 < 0 || dim1 < 0 || dim0 === dim1,\n      () =>\n      errorMessagePrefix + `Shapes ${shapeA} and ${shapeB} must match`);\n  }\n}\n\nexport\nfunction fullDefinedShape(elementShape: number|number[]): boolean {\n  if (typeof elementShape === 'number' ||\n  elementShape.some(dim => dim < 0)) {\n    return false;\n  }\n  return true;\n}\n\n/**\n * Generate the output element\n shape from the list elementShape, list tensors\n * and input param.\n *\n * @param listElementShape\n * @param\n tensors\n * @param elementShape\n */\nexport function inferElementShape(\n  listElementShape:\n  number|number[], tensors: Tensor[],\n  elementShape: number|number[]): number[] {\n  let partialShape =\n  mergeElementShape(listElementShape, elementShape);\n  const notfullDefinedShape =\n  !fullDefinedShape(partialShape);\n  if (notfullDefinedShape && tensors.length === 0) {\n    throw new Error(\n    `Tried to calculate elements of an empty list` +\n    ` with non-fully-defined elementShape: ${partialShape}`);\n  }\n  if (notfullDefinedShape) {\n    tensors.forEach(tensor => {\n      partialShape =\n      mergeElementShape(tensor.shape, partialShape);\n    });\n  }\n  if (!fullDefinedShape(partialShape)) {\n    throw\n    new Error(`Non-fully-defined elementShape: ${partialShape}`);\n  }\n  return partialShape as\n  number[];\n}\n\nexport function mergeElementShape(\n  elementShapeA: number|number[], elementShapeB:\n  number|number[]): number|\n  number[] {\n  if (typeof elementShapeA === 'number') {\n    return\n    elementShapeB;\n  }\n  if (typeof elementShapeB === 'number') {\n    return elementShapeA;\n  }\n  if\n  (elementShapeA.length !== elementShapeB.length) {\n    throw new Error(`Incompatible ranks during merge:\n  ${elementShapeA} vs. ${\n    elementShapeB}`);\n  }\n  const result: number[] = [];\n  for (let i = 0; i <\n  elementShapeA.length; ++i) {\n    const dim0 = elementShapeA[i];\n    const dim1 = elementShapeB[i];\n    if (dim0\n  >= 0 && dim1 >= 0 && dim0 !== dim1) {\n      throw new Error(`Incompatible shape during merge:\n  ${elementShapeA} vs. ${\n    elementShapeB}`);\n    }\n    result[i] = dim0 >= 0 ? dim0 : dim1;\n  }\n  return\n  result;\n}\n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n * =====\n *\n */\nimport {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from\n '@tensorflow/tfjs-core';\nimport {assertShapesMatchAllowUndefinedSize} from './tensor_utils';\nexport

```

```

interface TensorWithState {\n  tensor?: Tensor;\n  written?: boolean;\n  read?: boolean;\n  cleared?:
boolean;\n}\n/**\n * The TensorArray object keeps an array of Tensors. It\n * allows reading from the array and
writing to the array.\n */\nexport class TensorArray {\n  private tensors: TensorWithState[] = [];\n  private closed_ =
false;\n  readonly idTensor: Tensor;\n  constructor(\n    readonly name: string, readonly dtype: DataType, private
maxSize: number,\n    private elementShape: number[], readonly identicalElementShapes: boolean,\n    readonly dynamicSize: boolean, readonly clearAfterRead: boolean) {\n    this.idTensor = scalar(0);\n    keep(this.idTensor);\n  }\n  get id() {\n    return this.idTensor.id;\n  }\n  get closed() {\n    return this.closed_;\n  }\n  /**\n * Dispose
the tensors and idTensor and mark the TensorArray as closed.\n */\n  clearAndClose(keepIds?: Set<number>) {\n
    this.tensors.forEach(tensor => {\n      if (keepIds == null || !keepIds.has(tensor.tensor.id)) {\n
        tensor.tensor.dispose();\n      }\n    });\n    this.tensors = [];\n    this.closed_ = true;\n    this.idTensor.dispose();\n  }\n  size(): number {\n    return this.tensors.length;\n  }\n  /**\n * Read the value at location index in the
TensorArray.\n * @param index Number the index to read from.\n */\n  read(index: number): Tensor {\n    if
(this.closed_) {\n      throw new Error(`TensorArray ${this.name} has already been closed.`);\n    }\n    if (index <
0 || index >= this.size()) {\n      throw new Error(`Tried to read from index ${index}, but array size is: ${\n
this.size()}`);\n    }\n    const tensorWithState = this.tensors[index];\n    if (tensorWithState.cleared) {\n      throw
new Error(\n      `TensorArray ${this.name}: Could not read index ${\n        index} twice because it was
cleared after a previous read` +\n      `(perhaps try setting clear_after_read = false?`.);\n    }\n    if
(this.clearAfterRead) {\n      tensorWithState.cleared = true;\n    }\n    tensorWithState.read = true;\n    return
tensorWithState.tensor;\n  }\n  /**\n * Helper method to read multiple tensors from the specified indices.\n */\n  readMany(indices: number[]): Tensor[] {\n    return indices.map(index => this.read(index));\n  }\n  /**\n * Write
value into the index of the TensorArray.\n * @param index number the index to write to.\n * @param tensor\n
*/\n  write(index: number, tensor: Tensor) {\n    if (this.closed_) {\n      throw new Error(`TensorArray ${this.name}
has already been closed.`);\n    }\n    if (index < 0 || !this.dynamicSize && index >= this.maxSize) {\n      throw
new Error(`Tried to write to index ${\n      index}, but array is not resizeable and size is: ${this.maxSize}`);\n    }\n    const t = this.tensors[index] || {};\n    if (tensor.dtype !== this.dtype) {\n      throw new Error(`TensorArray
${\n      this.name}: Could not write to TensorArray index ${index},\n      because the value dtype is ${\n
tensor.dtype}, but TensorArray dtype is ${this.dtype}`);\n    }\n    // Set the shape for the first time write to
unknown shape tensor array\n    if (this.size() === 0 &&\n      (this.elementShape == null || this.elementShape.length
=== 0)) {\n      this.elementShape = tensor.shape;\n    }\n    assertShapesMatchAllowUndefinedSize(\n
this.elementShape, tensor.shape,\n    `TensorArray ${this.name}: Could not write to TensorArray index ${\n
index}`);\n    if (t.read) {\n      throw new Error(\n      `TensorArray ${this.name}: Could not write to
TensorArray index ${\n        index}, because it has already been read.`);\n    }\n    if (t.written) {\n      throw
new Error(\n      `TensorArray ${this.name}: Could not write to TensorArray index ${\n        index}, because
it has already been written.`);\n    }\n    t.tensor = tensor;\n    keep(tensor);\n    t.written = true;\n    this.tensors[index] = t;\n  }\n  /**\n * Helper method to write multiple tensors to the specified indices.\n */\n  writeMany(indices: number[], tensors: Tensor[]) {\n    if (indices.length !== tensors.length) {\n      throw new
Error(\n      `TensorArray ${this.name}: could not write multiple tensors,` +\n      `because the index size: ${\n
indices.length} is not the same as tensors size: ${\n      tensors.length}`);\n    }\n    indices.forEach((i,
index) => this.write(i, tensors[index]));\n  }\n  /**\n * Return selected values in the TensorArray as a packed
Tensor. All of\n * selected values must have been written and their shapes must all match.\n * @param [indices]
number[] Optional. Taking values in [0, max_value). If the\n * TensorArray is not dynamic, max_value=size(). If
not specified returns\n * all tensors in the original order.\n * @param [dtype]\n */\n  gather(indices?: number[],
dtype?: DataType): Tensor {\n    if (!dtype && dtype !== this.dtype) {\n      throw new Error(`TensorArray dtype is
${\n      this.dtype} but gather requested dtype ${dtype}`);\n    }\n    if (!indices) {\n      indices = [];\n      for (let
i = 0; i < this.size(); i++) {\n        indices.push(i);\n      }\n    } else {\n      indices = indices.slice(0, this.size());\n    }\n    if (indices.length === 0) {\n      return tensor([], [0].concat(this.elementShape));\n    }\n    // Read all the
PersistentTensors into a vector to keep track of\n    // their memory.\n    const tensors = this.readMany(indices);\n    assertShapesMatchAllowUndefinedSize(\n      this.elementShape, tensors[0].shape, "TensorArray shape mismatch:

```



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maximum allowed size of `tensors`. Defaults to -1\n * meaning that the size of `tensors` is unbounded.\n *\n
constructor(\n  readonly tensors: Tensor[], readonly elementShape: number|number[],\n  readonly
elementDtype: DataType, maxNumElements = -1) {\n  if (tensors != null) {\n    tensors.forEach(tensor => {\n
if (elementDtype !== tensor.dtype) {\n      throw new Error(`Invalid data types; op elements ${\n
elementDtype}, but list elements ${tensor.dtype}`);\n    }\n    assertShapesMatchAllowUndefinedSize(\n
elementShape, tensor.shape, 'TensorList shape mismatch: ');\n    keep(tensor);\n  });\n  }\n  this.idTensor =
scalar(0);\n  this.maxNumElements = maxNumElements;\n  keep(this.idTensor);\n }\n\n /**\n * Get a new
TensorList containing a copy of the underlying tensor container.\n *\n copy(): TensorList {\n  return new
TensorList(\n    [...this.tensors], this.elementShape, this.elementDtype);\n }\n\n /**\n * Dispose the tensors and
idTensor and clear the tensor list.\n *\n clearAndClose(keepIds?: Set<number>) {\n  this.tensors.forEach(tensor
=> {\n    if (keepIds == null || !keepIds.has(tensor.id)) {\n      tensor.dispose();\n    }\n  });\n  this.tensors.length = 0;\n  this.idTensor.dispose();\n }\n\n /**\n * The size of the tensors in the tensor list.\n *\n size() {\n  return this.tensors.length;\n }\n\n /**\n * Return a tensor that stacks a list of rank-R tf.Tensors into
one rank-(R+1)\n * tf.Tensor.\n * @param elementShape shape of each tensor\n * @param elementDtype data
type of each tensor\n * @param numElements the number of elements to stack\n *\n stack(elementShape:
number[], elementDtype: DataType, numElements = -1):\n  Tensor {\n  if (elementDtype !== this.elementDtype)
{\n    throw new Error(`Invalid data types; op elements ${\n      elementDtype}, but list elements
${this.elementDtype}`);\n  }\n  if (numElements !== -1 && this.tensors.length !== numElements) {\n    throw
new Error(`Operation expected a list with ${\n      numElements} elements but got a list with ${\n
this.tensors.length} elements.`);\n  }\n  assertShapesMatchAllowUndefinedSize(\n    elementShape,
this.elementShape, 'TensorList shape mismatch: ');\n  const outputElementShape =\n    inferElementShape(this.elementShape, this.tensors, elementShape);\n  return tidy(() => {\n    const
reshapedTensors =\n      this.tensors.map(tensor => reshape(tensor, outputElementShape));\n    return
stack(reshapedTensors, 0);\n  });\n }\n\n /**\n * Pop a tensor from the end of the list.\n * @param
elementShape shape of the tensor\n * @param elementDtype data type of the tensor\n *\n popBack(elementShape: number[], elementDtype: DataType): Tensor {\n  if (elementDtype !==
this.elementDtype) {\n    throw new Error(`Invalid data types; op elements ${\n      elementDtype}, but list
elements ${this.elementDtype}`);\n  }\n\n  if (this.size() === 0) {\n    throw new Error('Trying to pop from an
empty list.);\n  }\n  const outputElementShape =\n    inferElementShape(this.elementShape, this.tensors,
elementShape);\n  const tensor = this.tensors.pop();\n  assertShapesMatchAllowUndefinedSize(\n    tensor.shape, elementShape, 'TensorList shape mismatch: ');\n  return reshape(tensor, outputElementShape);\n }\n\n /**\n * Push a tensor to the end of the list.\n * @param tensor Tensor to be pushed.\n *\n pushBack(tensor: Tensor) {\n  if (tensor.dtype !== this.elementDtype) {\n    throw new Error(`Invalid data types;
op elements ${\n      tensor.dtype}, but list elements ${this.elementDtype}`);\n  }\n\n  assertShapesMatchAllowUndefinedSize(\n    tensor.shape, this.elementShape, 'TensorList shape mismatch: ');\n  if (this.maxNumElements === this.size()) {\n    throw new Error('Trying to push element into a full list.);\n  }\n  keep(tensor);\n  this.tensors.push(tensor);\n }\n\n /**\n * Update the size of the list.\n * @param size the new
size of the list.\n *\n resize(size: number) {\n  if (size < 0) {\n    throw new Error(\n      `TensorListResize
expects size to be non-negative. Got: ${size}`);\n  }\n\n  if (this.maxNumElements !== -1 && size >
this.maxNumElements) {\n    throw new Error(`TensorListResize input size ${\n      size} is greater
maxNumElement ${this.maxNumElements}.`);\n  }\n  this.tensors.length = size;\n }\n\n /**\n * Retrieve the
element at the provided index\n * @param elementShape shape of the tensor\n * @param elementDtype dtype of
the tensor\n * @param elementIndex index of the tensor\n *\n getItem(elementIndex: number, elementShape:
number[], elementDtype: DataType):\n  Tensor {\n  if (elementDtype !== this.elementDtype) {\n    throw new
Error(`Invalid data types; op elements ${\n      elementDtype}, but list elements ${this.elementDtype}`);\n  }\n
if (elementIndex < 0 || elementIndex > this.tensors.length) {\n    throw new Error(`Trying to access element ${\n
    elementIndex} in a list with ${this.tensors.length} elements.`);\n  }\n\n  if (this.tensors[elementIndex] == null)
{\n    throw new Error(`element at index ${elementIndex} is null.);\n  }\n\n

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assertShapesMatchAllowUndefinedSize(\n    this.tensors[elementIndex].shape, elementShape,\n    'TensorList\n    shape mismatch: ');
\n    const outputElementShape =\n        inferElementShape(this.elementShape, this.tensors,\n        elementShape);
\n    return reshape(this.tensors[elementIndex], outputElementShape);
\n }
\n\n /**
\n * Set the\n    tensor at the index
\n * @param elementIndex index of the tensor
\n * @param tensor the tensor to be inserted into\n    the list
\n */
\n setItem(elementIndex: number, tensor: Tensor) {\n    if (tensor.dtype !== this.elementDtype) {\n        throw new Error(`Invalid data types; op elements ${\n            tensor.dtype}, but list elements\n        ${this.elementDtype}`);
\n    }
\n    if (elementIndex < 0 ||\n        this.maxNumElements !== -1 && elementIndex\n        >= this.maxNumElements) {\n        throw new Error(`Trying to set element ${\n            elementIndex} in a list with\n        max ${this.maxNumElements} elements.`);
\n    }
\n    assertShapesMatchAllowUndefinedSize(\n        this.elementShape, tensor.shape, 'TensorList shape mismatch: ');
\n    keep(tensor);
\n    this.tensors[elementIndex] =\n        tensor;
\n }
\n\n /**
\n * Return selected values in the TensorList as a stacked Tensor. All of\n    * selected values\n    must have been written and their shapes must all match.
\n * @param indices indices of tensors to gather
\n * @param elementDtype output tensor dtype
\n * @param elementShape output tensor element shape
\n */
\n gather(indices: number[], elementDtype: DataType, elementShape: number[]):\n    Tensor {\n    if (elementDtype\n        !== this.elementDtype) {\n        throw new Error(`Invalid data types; op elements ${\n            elementDtype}, but list\n        elements ${this.elementDtype}`);
\n    }
\n    assertShapesMatchAllowUndefinedSize(\n        this.elementShape,\n        elementShape, 'TensorList shape mismatch: ');
\n    // When indices is greater than the size of the list, indices\n    // beyond the\n    // size of the list are ignored.
\n    indices = indices.slice(0, this.size());
\n    const outputElementShape\n        =\n        inferElementShape(this.elementShape, this.tensors, elementShape);
\n    if (indices.length === 0) {\n        return tensor([], [0].concat(outputElementShape));
\n    }
\n    return tidy(() => {\n        const tensors =\n        indices.map(i => reshape(this.tensors[i], outputElementShape));
\n        return stack(tensors, 0);
\n    });
\n }
\n\n /**
\n * Return the values in the TensorList as a concatenated Tensor.
\n * @param elementDtype output tensor dtype
\n * @param elementShape output tensor element shape
\n */
\n concat(elementDtype: DataType, elementShape:\n    number[]): Tensor {\n    if (!elementDtype && elementDtype !== this.elementDtype) {\n        throw new\n        Error(`TensorList dtype is ${\n            this.elementDtype} but concat requested dtype ${\n            elementDtype}`);
\n    }
\n    assertShapesMatchAllowUndefinedSize(\n        this.elementShape, elementShape, 'TensorList shape mismatch: ');
\n    const outputElementShape =\n        inferElementShape(this.elementShape, this.tensors, elementShape);
\n    if\n        (this.size() === 0) {\n        return tensor([], [0].concat(outputElementShape));
\n    }
\n    return tidy(() => {\n        const\n        tensors = this.tensors.map(t => reshape(t, outputElementShape));
\n        return concat(tensors, 0);
\n    });
\n }
\n\n /**
\n * Creates a TensorList which, when stacked, has the value of tensor.
\n * @param tensor from tensor
\n * @param elementShape output tensor element shape
\n */
\n export function fromTensor(\n    tensor: Tensor,\n    elementShape: number[], elementDtype: DataType) {\n    const dtype = tensor.dtype;
\n    if (tensor.shape.length < 1)\n        {\n        throw new Error(`\n            Tensor must be at least a vector, but saw shape: ${\n            tensor.shape}`);
\n    }
\n    if\n        (tensor.dtype !== elementDtype) {\n        throw new Error(`Invalid data types; op elements ${\n            tensor.dtype}, but\n        list elements ${elementDtype}`);
\n    }
\n    const tensorElementShape = tensor.shape.slice(1);
\n    assertShapesMatchAllowUndefinedSize(\n        tensorElementShape, elementShape, 'TensorList shape mismatch:\n        ');
\n    const tensorList: Tensor[] = unstack(tensor);
\n    return new TensorList(tensorList, elementShape,\n        dtype);
\n }
\n\n /**
\n * Return a TensorList of the given size with empty elements.
\n * @param elementShape the\n    shape of the future elements of the list
\n * @param elementDtype the desired type of elements in the list
\n * @param numElements the number of elements to reserve
\n */
\n export function reserve(\n    elementShape:\n    number[], elementDtype: DataType, numElements: number) {\n    return new TensorList([], elementShape,\n        elementDtype, numElements);
\n }
\n\n /**
\n * Put tensors at specific indices of a stacked tensor into a TensorList.
\n * @param indices list of indices on how to scatter the tensor.
\n * @param tensor input tensor.
\n * @param\n    elementShape the shape of the future elements of the list
\n * @param\n    numElements the number of elements to\n    scatter
\n */
\n export function scatter(\n    tensor: Tensor, indices: number[], elementShape: number[],\n    numElements?: number): TensorList {\n    if (indices.length !== tensor.shape[0]) {\n        throw new Error(`Expected\n        len(indices) == tensor.shape[0], but saw: ${\n            indices.length} vs. ${\n            tensor.shape[0]}`);
\n    }
\n    const maxIndex\n        = Math.max(...indices);
\n    if (numElements != null && numElements !== -1 && maxIndex >= numElements) {\n

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throw new Error(`Max index must be < array size (${maxIndex} vs. ${numElements})`);
}
const list = new TensorList([], elementShape, tensor.dtype, numElements);
const tensors = unstack(tensor, 0);
indices.forEach((value, index) => {
  list.setItem(value, tensors[index]);
});
return list;
}

/**
 * Split the values of a Tensor into a TensorList.
 * @param length the lengths to use when splitting value along its first
 * dimension.
 * @param tensor the tensor to split.
 * @param elementShape the shape of the future elements of the
 * list.
 * @export function split(tensor: Tensor, length: number[], elementShape: number[]) {
 * let totalLength = 0;
 * const cumulativeLengths = length.map(len => {
 *   totalLength += len;
 *   return totalLength;
 * });
 * if (totalLength !== tensor.shape[0]) {
 *   throw new Error(`Expected sum of lengths to be equal to ${
 *     tensor.shape[0], but sum of lengths is ${totalLength}, and tensor's shape is: ${
 *       tensor.shape}`);
 * }
 * const shapeWithoutFirstDim = tensor.shape.slice(1);
 * const outputElementShape = mergeElementShape(shapeWithoutFirstDim, elementShape);
 * const elementPerRow = totalLength === 0 ? 0 : tensor.size / totalLength;
 * const tensors: Tensor[] = tidy(() => {
 *   const tensors = [];
 *   tensor = reshape(tensor, [1, totalLength, elementPerRow]);
 *   for (let i = 0; i < length.length; ++i) {
 *     const previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];
 *     const indices = [0, previousLength, 0];
 *     const sizes = [1, length[i], elementPerRow];
 *     tensors[i] = reshape(slice(tensor, indices, sizes), outputElementShape as number[]);
 *     tensor.dispose();
 *   }
 *   return tensors;
 * });
 * const list = new TensorList([], elementShape, tensor.dtype, length.length);
 * for (let i = 0; i < tensors.length; i++) {
 *   list.setItem(i, tensors[i]);
 * }
 * return list;
 * }
 *
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*
import {DataType, scalar, Tensor} from '@tensorflow/tfjs-core';
import {NamedTensorsMap} from '../data/types';
import {ExecutionContext} from '../executor/execution_context';
import {TensorArray} from '../executor/tensor_array';
import {fromTensor, reserve, scatter, split} from '../executor/tensor_list';
import {InternalOpAsyncExecutor, Node} from './types';
import {cloneTensor, getParamValue, getTensor} from './utils';
export const executeOp: InternalOpAsyncExecutor = async(node: Node, tensorMap:
NamedTensorsMap, context: ExecutionContext): Promise<Tensor[]> => {
  switch (node.op) {
    case 'If':
    case 'StatelessIf': {
      const thenFunc = getParamValue('thenBranch', node, tensorMap, context) as
string;
      const elseFunc = getParamValue('elseBranch', node, tensorMap, context) as
string;
      const cond = getParamValue('cond', node, tensorMap, context) as Tensor;
      const args = getParamValue('args', node, tensorMap, context) as Tensor[];
      const condValue = await cond.data();
      if (condValue[0]) {
        return context.functionMap[thenFunc].executeFunctionAsync(args, context.tensorArrayMap,
context.tensorListMap);
      } else {
        return context.functionMap[elseFunc].executeFunctionAsync(args, context.tensorArrayMap,
context.tensorListMap);
      }
    }
    case 'While':
    case 'StatelessWhile': {
      const bodyFunc = getParamValue('body', node, tensorMap, context) as string;
      const condFunc = getParamValue('cond', node, tensorMap, context) as string;
      const args = getParamValue('args', node, tensorMap, context) as Tensor[];
      // Calculate the condition of the loop
      const condResult = (await context.functionMap[condFunc].executeFunctionAsync(args, context.tensorArrayMap,
context.tensorListMap));
      const argIds = args.map(tensor => tensor.id);
      let condValue = await condResult[0].data();
      // Dispose the intermediate tensors for condition function
      condResult.forEach(tensor => {
        if (!tensor.kept && argIds.indexOf(tensor.id) === -1) {
          tensor.dispose();
        }
      });
      let result: Tensor[] = args;
      while (condValue[0]) {
        // Record the previous result for intermediate tensor
        tracking
        const origResult = result;
        // Execution the body of the loop
        result = await context.functionMap[bodyFunc].executeFunctionAsync(result, context.tensorArrayMap,
context.tensorListMap);
        const resultIds = result.map(tensor => tensor.id);
        // Dispose the intermediate

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tensor for body function that is not global\n    // kept, not input/output of the body function\n
origResult.forEach(tensor => {\n    if (!tensor.kept && argIds.indexOf(tensor.id) === -1 &&\n
resultIds.indexOf(tensor.id) === -1) {\n        tensor.dispose();\n    }\n});\n\n    // Recalculate the
condition of the loop using the latest results.\n    const condResult =\n        (await
context.functionMap[condFunc].executeFunctionAsync(\n        result, context.tensorArrayMap,
context.tensorListMap));\n    condValue = await condResult[0].data();\n    // Dispose the intermediate tensors
for condition function\n    condResult.forEach(tensor => {\n    if (!tensor.kept && argIds.indexOf(tensor.id)
=== -1 &&\n        resultIds.indexOf(tensor.id) === -1) {\n        tensor.dispose();\n    }\n});\n}\n
return result;\n}\n
case 'LoopCond': {\n    const pred = getParamValue('pred', node, tensorMap, context) as
Tensor;\n    return [cloneTensor(pred)];\n}\n
case 'Switch': {\n    const pred = getParamValue('pred', node,
tensorMap, context) as Tensor;\n    let data = getParamValue('data', node, tensorMap, context) as Tensor;\n    if
(!data.kept) {\n        data = cloneTensor(data);\n    }\n    // Outputs nodes :0 => false, :1 => true\n    return (await
pred.data())[0] ? [undefined, data] : [data, undefined];\n}\n
case 'Merge': {\n    const inputName =
node.inputNames.find(\n        name => getTensor(name, tensorMap, context) !== undefined);\n    if (inputName)
{\n        const data = getTensor(inputName, tensorMap, context);\n        return [cloneTensor(data)];\n    }\n
return undefined;\n}\n
case 'Enter': {\n    const frameId =\n        getParamValue('frameName', node,
tensorMap, context) as string;\n    const data = getParamValue('tensor', node, tensorMap, context) as Tensor;\n
context.enterFrame(frameId);\n    return [cloneTensor(data)];\n}\n
case 'Exit': {\n    const data =
getParamValue('tensor', node, tensorMap, context) as Tensor;\n    context.exitFrame();\n    return
[cloneTensor(data)];\n}\n
case 'NextIteration': {\n    const data = getParamValue('tensor', node, tensorMap,
context) as Tensor;\n    context.nextIteration();\n    return [cloneTensor(data)];\n}\n
case 'TensorArrayV3':
{\n    const size = getParamValue('size', node, tensorMap, context) as number;\n    const dtype =\n        getParamValue('dtype', node, tensorMap, context) as DataType;\n    const elementShape =\n        getParamValue('elementShape', node, tensorMap, context) as number[];\n    const dynamicSize =\n        getParamValue('dynamicSize', node, tensorMap, context) as boolean;\n    const clearAfterRead =\n        getParamValue('clearAfterRead', node, tensorMap, context) as boolean;\n    const identicalElementShapes =\n        getParamValue('identicalElementShapes', node, tensorMap, context) as\n        boolean;\n    const name =
getParamValue('name', node, tensorMap, context) as string;\n    const tensorArray = new TensorArray(\n        name, dtype, size, elementShape, identicalElementShapes, dynamicSize,\n        clearAfterRead);\n    context.addTensorArray(tensorArray);\n    return [tensorArray.idTensor, scalar(1.0)];\n}\n
case
'TensorArrayWriteV3': {\n    const id =\n        getParamValue('tensorArrayId', node, tensorMap, context) as
Tensor;\n    const index = getParamValue('index', node, tensorMap, context) as number;\n    const writeTensor =\n        getParamValue('tensor', node, tensorMap, context) as Tensor;\n    const writeTensorArray =
context.getTensorArray(id.id);\n    writeTensorArray.write(index, writeTensor);\n    return
[writeTensorArray.idTensor];\n}\n
case 'TensorArrayReadV3': {\n    const readId =\n        getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n    const readIndex =\n        getParamValue('index', node, tensorMap, context) as number;\n    const readTensorArray =
context.getTensorArray(readId.id);\n    return [readTensorArray.read(readIndex)];\n}\n
case
'TensorArrayGatherV3': {\n    const gatherId =\n        getParamValue('tensorArrayId', node, tensorMap, context)
as Tensor;\n    const gatherIndices =\n        getParamValue('indices', node, tensorMap, context) as number[];\n    const gatherDtype =\n        getParamValue('dtype', node, tensorMap, context) as DataType;\n    const
gatherTensorArray = context.getTensorArray(gatherId.id);\n    return [gatherTensorArray.gather(gatherIndices,
gatherDtype)];\n}\n
case 'TensorArrayScatterV3': {\n    const scatterId =\n        getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n    const scatterIndices =\n        getParamValue('indices', node, tensorMap, context) as number[];\n    const scatterTensor =\n        getParamValue('tensor', node, tensorMap, context) as Tensor;\n    const scatterTensorArray =
context.getTensorArray(scatterId.id);\n    scatterTensorArray.scatter(scatterIndices, scatterTensor);\n    return
[scatterTensorArray.idTensor];\n}\n
case 'TensorArrayConcatV3': {\n    const concatId =\n

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getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n    const concatTensorArray =
context.getTensorArray(concatId.id);\n    const concatDtype =\n        getParamValue('dtype', node, tensorMap,
context) as DataType;\n    return [concatTensorArray.concat(concatDtype)];\n }\n case 'TensorArraySplitV3':
{\n    const splitId =\n        getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n    const
splitTensor =\n        getParamValue('tensor', node, tensorMap, context) as Tensor;\n    const lengths =\n        getParamValue('lengths', node, tensorMap, context) as number[];\n    const splitTensorArray =
context.getTensorArray(splitId.id);\n    splitTensorArray.split(lengths, splitTensor);\n    return
[splitTensorArray.idTensor];\n }\n case 'TensorArraySizeV3': {\n    const sizeId =\n        getParamValue('tensorArrayId', node, tensorMap, context) as Tensor;\n    const sizeTensorArray =
context.getTensorArray(sizeId.id);\n    return [scalar(sizeTensorArray.size(), 'int32')];\n }\n case
'TensorArrayCloseV3': {\n    const closeId =\n        getParamValue('tensorArrayId', node, tensorMap, context) as
Tensor;\n    const closeTensorArray = context.getTensorArray(closeId.id);\n
closeTensorArray.clearAndClose();\n    return [closeTensorArray.idTensor];\n }\n case 'TensorListSetItem': {\n
    const idTensor =\n        getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n    const index =
getParamValue('index', node, tensorMap, context) as number;\n    const writeTensor =\n        getParamValue('tensor', node, tensorMap, context) as Tensor;\n    const tensorList =
context.getTensorList(idTensor.id);\n    tensorList.setItem(index, writeTensor);\n    return [tensorList.idTensor];\n
}\n case 'TensorListGetItem': {\n    const idTensor =\n        getParamValue('tensorListId', node, tensorMap,
context) as Tensor;\n    const readIndex =\n        getParamValue('index', node, tensorMap, context) as number;\n
    const elementShape =\n        getParamValue('elementShape', node, tensorMap, context) as number[];\n\n    const
elementDType =\n        getParamValue('elementDType', node, tensorMap, context) as DataType;\n    const
tensorList = context.getTensorList(idTensor.id);\n    return [tensorList.getItem(readIndex, elementShape,
elementDType)];\n }\n case 'TensorListScatterV2':\n case 'TensorListScatter': {\n    const scatterIndices =\n        getParamValue('indices', node, tensorMap, context) as number[];\n    const scatterTensor =\n        getParamValue('tensor', node, tensorMap, context) as Tensor;\n    const elementShape =\n        getParamValue('elementShape', node, tensorMap, context) as number[];\n    const numElements =\n        getParamValue('numElements', node, tensorMap, context) as number;\n    const tensorList =\n        scatter(scatterTensor, scatterIndices, elementShape, numElements);\n    context.addTensorList(tensorList);\n
return [tensorList.idTensor];\n }\n case 'TensorListReserve':\n case 'EmptyTensorList': {\n    const
elementShape =\n        getParamValue('elementShape', node, tensorMap, context) as number[];\n    const
elementDtype =\n        getParamValue('elementDType', node, tensorMap, context) as DataType;\n    let
numElementsParam;\n\n    if (node.op === 'TensorListReserve') {\n        numElementsParam = 'numElements';\n
    } else {\n        numElementsParam = 'maxNumElements';\n    }\n\n    const numElements =\n        getParamValue(numElementsParam, node, tensorMap, context) as number;\n\n    const tensorList =
reserve(elementShape, elementDtype, numElements);\n    context.addTensorList(tensorList);\n    return
[tensorList.idTensor];\n }\n case 'TensorListGather': {\n    const gatherId =\n        getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n    const gatherIndices =\n        getParamValue('indices', node, tensorMap, context) as number[];\n    const elementShape =\n        getParamValue('elementShape', node, tensorMap, context) as number[];\n    const elementDtype =\n        getParamValue('elementDType', node, tensorMap, context) as DataType;\n    const tensorList =
context.getTensorList(gatherId.id);\n    return [tensorList.gather(gatherIndices, elementDtype, elementShape)];\n
}\n case 'TensorListStack': {\n    const idTensor =\n        getParamValue('tensorListId', node, tensorMap,
context) as Tensor;\n    const elementShape =\n        getParamValue('elementShape', node, tensorMap, context) as
number[];\n    const elementDtype =\n        getParamValue('elementDType', node, tensorMap, context) as
DataType;\n    const numElements =\n        getParamValue('numElements', node, tensorMap, context) as
number;\n    const tensorList = context.getTensorList(idTensor.id);\n    return [tensorList.stack(elementShape,
elementDtype, numElements)];\n }\n case 'TensorListFromTensor': {\n    const tensor =\n        getParamValue('tensor', node, tensorMap, context) as Tensor;\n    const elementShape =\n

```



```

dataFormat,\n dilations,\n biasArg,\n preluArg,\n activationFunc,\n leakyreluAlpha\n };\n}\n\nexport const
executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context:
ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Conv1D': {\n const stride =\n getParamValue('stride', node, tensorMap, context) as number;\n const pad = getParamValue('pad', node,
tensorMap, context);\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context)
as string)\n .toUpperCase();\n const dilation =\n getParamValue('dilation', node, tensorMap,
context) as number;\n return [tfOps.conv1d(\n getParamValue('x', node, tensorMap, context) as
Tensor3D,\n getParamValue('filter', node, tensorMap, context) as Tensor3D,\n stride, pad as 'valid' |
'same', dataFormat as 'NWC' | 'NCW',\n dilation)];\n }\n case 'Conv2D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getPadding(node,
tensorMap, context);\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context)
as string)\n .toUpperCase();\n const dilations =\n getParamValue('dilations', node,
tensorMap, context) as number[];\n return [tfOps.conv2d(\n getParamValue('x', node, tensorMap,
context) as Tensor3D | \n Tensor4D,\n getParamValue('filter', node, tensorMap, context) as
Tensor4D,\n [stride[1], stride[2]], pad as 'valid' | 'same',\n dataFormat as 'NHWC' | 'NCHW',
[dilations[1], dilations[2]])];\n }\n case '_FusedConv2D': {\n const {\n stride,\n pad,\n
dataFormat,\n dilations,\n biasArg,\n preluArg,\n activationFunc,\n
leakyreluAlpha\n } = fusedConvAndDepthWiseParams(node, tensorMap, context);\n\n return
[tfOps.fused.conv2d({\n x: getParamValue('x', node, tensorMap, context) as Tensor3D | \n
Tensor4D,\n filter: getParamValue('filter', node, tensorMap, context) as \n Tensor4D,\n
strides: [stride[1], stride[2]],\n pad: pad as 'valid' | 'same',\n dataFormat: dataFormat as 'NHWC' |
'NCHW',\n dilations: [dilations[1], dilations[2]],\n bias: biasArg,\n activation: activationFunc as
tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n }));\n }\n\n
case 'FusedDepthwiseConv2dNative': {\n const {\n stride,\n pad,\n dataFormat,\n
dilations,\n biasArg,\n preluArg,\n activationFunc,\n leakyreluAlpha,\n } =
fusedConvAndDepthWiseParams(node, tensorMap, context);\n\n return [tfOps.fused.depthwiseConv2d({\n
x: getParamValue('x', node, tensorMap, context) as Tensor3D | \n Tensor4D,\n filter:
getParamValue('filter', node, tensorMap, context) as \n Tensor4D,\n strides: [stride[1], stride[2]],\n
pad: pad as 'valid' | 'same',\n dataFormat: dataFormat as 'NHWC' | 'NCHW',\n dilations:
[dilations[1], dilations[2]],\n bias: biasArg,\n activation: activationFunc as tfOps.fused.Activation,\n
preluActivationWeights: preluArg,\n leakyreluAlpha\n }));\n }\n\n case
'Conv2DBackpropInput':\n case 'Conv2dTranspose': {\n const shape = getParamValue(\n
'outputShape', node, tensorMap,\n context) as [number, number, number] | \n [number,
number, number, number];\n const stride =\n getParamValue('strides', node, tensorMap, context) as
number[];\n const pad = getPadding(node, tensorMap, context);\n return [tfOps.conv2dTranspose(\n
getParamValue('x', node, tensorMap, context) as Tensor3D | \n Tensor4D,\n
getParamValue('filter', node, tensorMap, context) as Tensor4D,\n shape, [stride[1], stride[2]], pad as 'valid' |
'same')];\n }\n case 'DepthwiseConv2dNative':\n case 'DepthwiseConv2d': {\n const stride =\n
getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getPadding(node,
tensorMap, context);\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as
number[];\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n
.toUpperCase();\n\n return [tfOps.depthwiseConv2d(\n getParamValue('input', node,
tensorMap, context) as Tensor3D | \n Tensor4D,\n getParamValue('filter', node, tensorMap,
context) as Tensor4D,\n [stride[1], stride[2]], pad as 'valid' | 'same',\n dataFormat as 'NHWC' |
'NCHW', [dilations[1], dilations[2]]);\n }\n case 'Conv3D': {\n const stride =\n
getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,
tensorMap, context);\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context)
as string)\n .toUpperCase();\n const dilations =\n getParamValue('dilations', node,

```



```

Hashtable contains a set of tensors, which can be accessed by key.\n */\nexport class Hashtable {\n  readonly\n  handle: Tensor;\n\n  // tslint:disable-next-line: no-any\n  private tensorMap: Map<any, Tensor>;\n\n  get id() {\n    return this.handle.id;\n  }\n\n  /**\n   * Constructor of Hashtable. Creates a hash table.\n   * @param\n   keyDType `dtype` of the table keys.\n   * @param valueDType `dtype` of the table values.\n   */\n  constructor(readonly keyDType: DataType, readonly valueDType: DataType) {\n    this.handle = scalar(0);\n    // tslint:disable-next-line: no-any\n    this.tensorMap = new Map<any, Tensor>();\n\n    keep(this.handle);\n  }\n\n  /**\n   * Dispose the tensors and handle and clear the hashtable.\n   */\n  clearAndClose() {\n    this.tensorMap.forEach(value => value.dispose());\n    this.tensorMap.clear();\n    this.handle.dispose();\n  }\n\n  /**\n   * The number of items in the hash table.\n   */\n  size(): number {\n    return this.tensorMap.size;\n  }\n\n  /**\n   * Replaces the contents of the table with the specified keys and values.\n   * @param keys Keys to store in\n   the hashtable.\n   * @param values Values to store in the hashtable.\n   */\n  async import(keys: Tensor, values:\n  Tensor): Promise<Tensor> {\n    this.checkKeyAndValueTensor(keys, values);\n\n    // We only store the primitive\n    values of the keys, this allows lookup\n    // to be O(1).\n    const $keys = await keys.data();\n\n    // Clear the\n    hashTable before inserting new values.\n    this.tensorMap.forEach(value => value.dispose());\n\n    this.tensorMap.clear();\n\n    return tidy(() => {\n      const $values = unstack(values);\n\n      const keysLength =\n      $keys.length;\n      const valuesLength = $values.length;\n\n      util.assert(\n        keysLength === valuesLength,\n        () => `The number of elements doesn't match, keys has ` +\n          `${keysLength} elements, the values has\n          ${valuesLength} ` +\n          `elements.`);\n\n      for (let i = 0; i < keysLength; i++) {\n        const key =\n        $keys[i];\n        const value = $values[i];\n\n        keep(value);\n        this.tensorMap.set(key, value);\n      }\n\n      return this.handle;\n    });\n  }\n\n  /**\n   * Looks up keys in a hash table, outputs the corresponding values.\n   */\n  * Performs batch lookups, for every element in the key tensor, `find`\n  * stacks the corresponding value into the\n  return tensor.\n  * If an element is not present in the table, the given `defaultValue` is\n  * used.\n  * @param keys Keys to look up. Must have the same type as the keys of the\n  * table.\n  * @param defaultValue\n  The scalar `defaultValue` is the value output for keys\n  * not present in the table. It must also be of the same\n  type as the\n  * table values.\n  */\n  async find(keys: Tensor, defaultValue: Tensor): Promise<Tensor> {\n    this.checkKeyAndValueTensor(keys, defaultValue);\n\n    const $keys = await keys.data();\n\n    return tidy(() =>\n    {\n      const result: Tensor[] = [];\n\n      for (let i = 0; i < $keys.length; i++) {\n        const key = $keys[i];\n\n        const value = this.findWithDefault(key, defaultValue);\n        result.push(value);\n      }\n\n      return stack(result);\n    }\n    );\n  }\n\n  // tslint:disable-next-line: no-any\n  private findWithDefault(key: any, defaultValue: Tensor): Tensor\n  {\n    const result = this.tensorMap.get(key);\n\n    return result != null ? result : defaultValue;\n  }\n\n  private\n  checkKeyAndValueTensor(key: Tensor, value: Tensor) {\n    if (key.dtype !== this.keyDType) {\n      throw new\n      Error(\n        `Expect key dtype ${this.keyDType}, but got ` +\n        `${key.dtype}`);\n    }\n\n    if (value.dtype\n    !== this.valueDType) {\n      throw new Error(\n        `Expect value dtype ${this.valueDType}, but got ` +\n        `${value.dtype}`);\n    }\n  }\n\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in\n   compliance with the License.\n   * You may obtain a copy of the License at\n   *  

http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing,\n   software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES\n   OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language\n   governing permissions and\n   * limitations under the License.\n   */\n  =====\n  */\n  import {DataType, Tensor} from '@tensorflow/tfjs-core';\n  import {NamedTensorsMap} from\n  './../data/types';\n  import {ExecutionContext} from\n  './../executor/execution_context';\n  import {Hashtable} from\n  './../executor/hash_table';\n  import {ResourceManager} from\n  './../executor/resource_manager';\n  import\n  {InternalOpAsyncExecutor, Node} from './types';\n  import {getParamValue} from\n  './utils';\n  export const\n  executeOp: InternalOpAsyncExecutor = async(\n    node: Node, tensorMap: NamedTensorsMap, context:\n    ExecutionContext,\n    resourceManager: ResourceManager): Promise<Tensor[]> => {\n    switch (node.op) {\n      case 'Hashtable':\n      case 'HashtableV2': {\n        const keyDType =\n        getParamValue('keyDType', node,\n

```


CATEGORY = 'image';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport { Tensor } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport { NamedTensorsMap } from\n'../../data/types';\nimport { ExecutionContext } from '../../executor/execution_context';\nimport { InternalOpExecutor,\nNode } from './types';\nimport { getParamValue } from './utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n  switch\n(node.op) {\n    case 'Equal': {\n      return [tfOps.equal(\n        getParamValue('a', node, tensorMap,\ncontext) as Tensor,\n        getParamValue('b', node, tensorMap, context) as Tensor)];\n    }\n    case\n'NotEqual': {\n      return [tfOps.notEqual(\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b', node, tensorMap, context) as Tensor)];\n    }\n    case 'Greater': {\n      return\n[tfOps.greater(\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b',\nnode, tensorMap, context) as Tensor)];\n    }\n    case 'GreaterEqual': {\n      return [tfOps.greaterEqual(\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b', node, tensorMap, context)\nas Tensor)];\n    }\n    case 'Less': {\n      return [tfOps.less(\n        getParamValue('a', node, tensorMap,\ncontext) as Tensor,\n        getParamValue('b', node, tensorMap, context) as Tensor)];\n    }\n    case\n'LessEqual': {\n      return [tfOps.lessEqual(\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b', node, tensorMap, context) as Tensor)];\n    }\n    case 'LogicalAnd': {\n      return\n[tfOps.logicalAnd(\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b',\nnode, tensorMap, context) as Tensor)];\n    }\n    case 'LogicalNot': {\n      return [tfOps.logicalNot(\n        getParamValue('a', node, tensorMap, context) as Tensor)];\n    }\n    case 'LogicalOr': {\n      return\n[tfOps.logicalOr(\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b',\nnode, tensorMap, context) as Tensor)];\n    }\n    case 'Select':\n    case 'SelectV2': {\n      return\n[tfOps.where(\n        getParamValue('condition', node, tensorMap, context) as Tensor,\n        getParamValue('a', node, tensorMap, context) as Tensor,\n        getParamValue('b', node, tensorMap, context) as\nTensor)];\n    }\n    default:\n      throw TypeError(`Node type ${node.op} is not implemented`);\n    }\n  };\n\nexport const CATEGORY = 'logical';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { Tensor, Tensor2D } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport { NamedTensorsMap } from\n'../../data/types';\nimport { ExecutionContext } from '../../executor/execution_context';\nimport\n{ InternalOpExecutor, Node } from './types';\nimport { getParamValue } from './utils';\n\nexport const executeOp:\nInternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[]\n=> {\n  switch (node.op) {\n    case 'BatchMatMul':\n    case 'BatchMatMulV2':\n    case 'MatMul':\n    case 'MatMulV2':\n      return [tfOps.matMul(\n        getParamValue('a', node, tensorMap, context) as Tensor2D,\n        getParamValue('b', node, tensorMap, context) as Tensor2D,\n        getParamValue('transposeA', node,
```


on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport * as tfc from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from './data/types';\nimport {ExecutionContext} from './executor/execution_context';\nimport {ResourceManager} from './executor/resource_manager';\nimport {NodeValueImpl} from './custom_op/node_value_impl';\nimport {getRegisteredOp} from './custom_op/register';\nimport * as arithmetic from './executors/arithmetic_executor';\nimport * as basicMath from './executors/basic_math_executor';\nimport * as control from './executors/control_executor';\nimport * as convolution from './executors/convolution_executor';\nimport * as creation from './executors/creation_executor';\nimport * as dynamic from './executors/dynamic_executor';\nimport * as evaluation from './executors/evaluation_executor';\nimport * as graph from './executors/graph_executor';\nimport * as hashTable from './executors/hash_table_executor';\nimport * as image from './executors/image_executor';\nimport * as logical from './executors/logical_executor';\nimport * as matrices from './executors/matrices_executor';\nimport * as normalization from './executors/normalization_executor';\nimport * as reduction from './executors/reduction_executor';\nimport * as sliceJoin from './executors/slice_join_executor';\nimport * as spectral from './executors/spectral_executor';\nimport * as transformation from './executors/transformation_executor';\nimport {Node} from './types';\n\n/**\n * Executes the op defined by the node object.\n * @param node\n * @param tensorMap contains tensors for executed nodes and weights\n * @param context contains tensors and information for running the current node.\n * @param resourceManager Optional. Contains global resources of the model.\n */\nexport function executeOp(\n  node: Node,\n  tensorMap: NamedTensorsMap,\n  context: ExecutionContext,\n  resourceManager?: ResourceManager):\n  tfc.Tensor[] | Promise<tfc.Tensor[]> {\n  const value = (\n    (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) => {\n      switch (node.category) {\n        case 'arithmetic':\n          return tfc.tidy(\n            () => arithmetic.executeOp(node, tensorMap, context));\n        case 'basic_math':\n          return tfc.tidy(\n            () => basicMath.executeOp(node, tensorMap, context));\n        case 'control':\n          return control.executeOp(node, tensorMap, context);\n        case 'convolution':\n          return tfc.tidy(\n            () => convolution.executeOp(node, tensorMap, context));\n        case 'creation':\n          return tfc.tidy(() => creation.executeOp(node, tensorMap, context));\n        case 'dynamic':\n          return dynamic.executeOp(node, tensorMap, context);\n        case 'evaluation':\n          return tfc.tidy(\n            () => evaluation.executeOp(node, tensorMap, context));\n        case 'image':\n          return tfc.tidy(() => image.executeOp(node, tensorMap, context));\n        case 'graph':\n          return tfc.tidy(() => graph.executeOp(node, tensorMap, context));\n        case 'logical':\n          return tfc.tidy(() => logical.executeOp(node, tensorMap, context));\n        case 'matrices':\n          return tfc.tidy(() => matrices.executeOp(node, tensorMap, context));\n        case 'normalization':\n          return tfc.tidy(\n            () => normalization.executeOp(node, tensorMap, context));\n        case 'reduction':\n          return tfc.tidy(\n            () => reduction.executeOp(node, tensorMap, context));\n        case 'slice_join':\n          return tfc.tidy(\n            () => sliceJoin.executeOp(node, tensorMap, context));\n        case 'spectral':\n          return tfc.tidy(() => spectral.executeOp(node, tensorMap, context));\n        case 'transformation':\n          return tfc.tidy(\n            () => transformation.executeOp(node, tensorMap, context));\n        case 'hash_table':\n          return hashTable.executeOp(\n            node, tensorMap, context, resourceManager);\n        case 'custom':\n          const opMapper = getRegisteredOp(node.op);\n          if (opMapper && opMapper.customExecutor) {\n            return opMapper.customExecutor(\n              new NodeValueImpl(node, tensorMap, context));\n          } else {\n            throw TypeError(`Custom op ${node.op} is not registered.`);\n          }\n          default:\n            throw TypeError(\n              `Unknown op '${node.op}'. File an issue at ` +\n                `https://github.com/tensorflow/tfjs/issues so we can add it` +\n                `, or register a custom execution with tf.registerOp()`);\n          }\n      })(node, tensorMap, context);\n  if (tfc.util.isPromise(value)) {\n    return (value as Promise<tfc.Tensor>).then((data) => [].concat(data));\n  }\n  return [].concat(value);\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
```

\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

=====
*\nimport {Tensor} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap, TensorArrayMap,
TensorListMap} from './data/types';\n\nimport {TensorArray} from './tensor_array';\nimport {TensorList} from
 './tensor_list';\nimport {FunctionExecutor} from './types';\n\nexport interface ExecutionContextInfo {\n id: number;
// the unique id of the context info\n frameName: string; // The frame name of the loop, this comes from\n
// the TensorFlow NodeDef.\n iterationId: number; // The iteration id of the loop\n}\n\n/**\n *
ExecutionContext captures the runtime environment of the node. It keeps\n * track of the current frame and iteration
for the control flow ops.\n *\n * For example, typical Dynamic RNN model may contain loops, for which\n *
TensorFlow will generate graphs with Enter/Exit nodes to control the\n * current execution frame, and NextIteration
Nodes for iteration id increment.\n * For model with branch logic, TensorFlow will generate Switch/Merge ops.\n
*\n\nexport class ExecutionContext {\n private rootContext = {id: 0, frameName: "", iterationId: 0};\n private
contexts: ExecutionContextInfo[] = [this.rootContext];\n private lastId = 0;\n private _currentContextIds:
string[];\n\n constructor(\n readonly weightMap: NamedTensorsMap = {},\n readonly tensorArrayMap:
TensorArrayMap = {},\n readonly tensorListMap: TensorListMap = {},\n readonly functionMap: {[key:
string]: FunctionExecutor} = {}) {\n this.generateCurrentContextIds();\n }\n\n private newFrame(id: number,
frameName: string) {\n return {id, frameName, iterationId: 0};\n }\n\n /**\n * Set the current context\n *
@param contexts: ExecutionContextInfo[] the current path of execution\n * frames\n */\n set
currentContext(contexts: ExecutionContextInfo[]) {\n if (this.contexts !== contexts) {\n this.contexts =
contexts;\n this.generateCurrentContextIds();\n }\n }\n\n get currentContext(): ExecutionContextInfo[] {\n
return this.contexts;\n }\n\n /**\n * Returns the current context in string format.\n */\n get currentContextId():
string {\n return this._currentContextIds[0];\n }\n\n /**\n * Returns the current context and all parent contexts
in string format.\n * This allow access to the nodes in the current and parent frames.\n */\n get
currentContextIds(): string[] {\n return this._currentContextIds;\n }\n\n private generateCurrentContextIds() {\n
const names = [];\n for (let i = 0; i < this.contexts.length - 1; i++) {\n const contexts = this.contexts.slice(0,
this.contexts.length - i);\n names.push(this.contextIdforContexts(contexts));\n }\n names.push("");\n
this._currentContextIds = names;\n }\n\n private contextIdforContexts(contexts: ExecutionContextInfo[]) {\n
return contexts ?\n contexts\n .map(\n context => (context.id === 0 && context.iterationId ===
0) ?\n "" :\n `${context.frameName}-${context.iterationId}`)\n .join('/') :\n "";\n }\n\n /**\n * Enter a new frame, a new context is pushed on the current context list.\n *
@param frameId new
frame id\n */\n enterFrame(frameId: string) {\n if (this.contexts) {\n this.lastId++;\n this.contexts =
this.contexts.slice();\n this.contexts.push(this.newFrame(this.lastId, frameId));\n
this._currentContextIds.unshift(this.contextIdforContexts(this.contexts));\n }\n }\n\n /**\n * Exit the current
frame, the last context is removed from the current\n * context list.\n */\n exitFrame() {\n if (this.contexts &&
this.contexts.length > 1) {\n this.contexts = this.contexts.slice();\n this.contexts.splice(-1);\n
this.currentContextIds.shift();\n } else {\n throw new Error('Cannot exit frame, the context is empty');\n }\n
}\n\n /**\n * Enter the next iteration of a loop, the iteration id of last context is\n * increased.\n */\n
nextIteration() {\n if (this.contexts && this.contexts.length > 0) {\n this.contexts = this.contexts.slice();\n
this.lastId++;\n const context =\n Object.assign({}, this.contexts[this.contexts.length - 1]);\n
context.iterationId += 1;\n context.id = this.lastId;\n this.contexts.splice(-1, 1, context);\n
this._currentContextIds.splice(\n 0, 1, this.contextIdforContexts(this.contexts));\n } else {\n throw new
Error('Cannot increase frame iteration, the context is empty');\n }\n }\n\n getWeight(name: string): Tensor[] {\n
return this.weightMap[name];\n }\n\n addTensorArray(tensorArray: TensorArray) {\n
this.tensorArrayMap[tensorArray.id] = tensorArray;\n }\n\n getTensorArray(id: number): TensorArray {\n return

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this.tensorArrayMap[id];\n }\n\n addTensorList(tensorList: TensorList) {\n  this.tensorListMap[tensorList.id] =
tensorList;\n }\n\n getTensorList(id: number): TensorList {\n  return this.tensorListMap[id];\n }\n\n
dispose(keepIds: Set<number>) {\n  for (const key in this.tensorArrayMap) {\n
this.tensorArrayMap[key].clearAndClose(keepIds);\n  }\n\n  for (const key in this.tensorListMap) {\n
this.tensorListMap[key].clearAndClose(keepIds);\n  }\n }\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {NamedTensorMap} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from
'./data/types';\n\nimport {parseNodeName} from './operations/executors/utils';\n\nimport {Graph, Node} from
'./operations/types';\n\nexport interface ExecutionInfo {\n  inputs: NamedTensorMap;\n  outputs: Node[];\n
usedNodes: Set<string>;\n  missingInputs: string[];\n  dynamicNode: Node;\n  syncInputs: string[];\n }\n\n/**\n *
Given graph inputs and desired outputs, find the minimal set of nodes\n * to execute in order to compute the outputs.
In addition return other useful\n * info such:\n * - Missing inputs needed to compute the output.\n * - Whether the
subgraph contains dynamic ops (control flow, dynamic shape).\n * - Alternative inputs in order to avoid async
(dynamic op) execution.\n */\n\nexport function getExecutionSubgraph(\n  inputs: NamedTensorMap, outputs:
Node[], weightMap: NamedTensorsMap,\n  initNodes?: Node[]): ExecutionInfo {\n  const usedNodes = new
Set<string>();\n  const missingInputs: string[] = [];\n  let dynamicNode: Node = null;\n  let syncInputs: string[] =
null;\n\n  // Start with the outputs, going backwards and find all the nodes that are\n // needed to compute those
outputs.\n  const seen = new Set<string>();\n  const inputNodeNames =\n    Object.keys(inputs).map(name =>
parseNodeName(name)[0]);\n\n  let initNodeNames: string[] = [];\n  if (initNodes != null) {\n    initNodeNames =
initNodes.map(node => parseNodeName(node.name)[0]);\n  }\n\n  const frontier = [...outputs];\n  while
(frontier.length > 0) {\n    const node = frontier.pop();\n    if (isControlFlow(node) || isDynamicShape(node) ||
isHashTable(node)) {\n      if (dynamicNode == null) {\n        dynamicNode = node;\n        syncInputs =
dynamicNode.children.map(child => child.name)\n          .filter(name => usedNodes.has(name));\n      }\n
}\n    usedNodes.add(node.name);\n\n    // Weights are dead end since we already have their values.\n    if
(weightMap[node.name] != null) {\n      continue;\n    }\n    // This node is a dead end since it's one of the user-
provided inputs.\n    if (inputNodeNames.indexOf(node.name) !== -1) {\n      continue;\n    }\n    // This node is a
dead end since it doesn't have any inputs.\n    if (initNodeNames.indexOf(node.name) !== -1) {\n      continue;\n
}\n    if (node.inputs.length === 0) {\n      missingInputs.push(node.name);\n      continue;\n    }\n    node.inputs.forEach(input => {\n      // Don't add to the frontier if it is already there.\n      if (seen.has(input.name))
{\n        return;\n      }\n      seen.add(input.name);\n      frontier.push(input);\n    });\n  }\n  return {inputs, outputs,
usedNodes, missingInputs, dynamicNode, syncInputs};\n }\n\n/**\n * Given the execution info, return a list of nodes
in topological order that\n * need to be executed to compute the output.\n */\n\nexport function
getNodesInTopologicalOrder(\n  graph: Graph, weightMap: NamedTensorsMap,\n  executionInfo:
ExecutionInfo): Node[] {\n  const {usedNodes, inputs} = executionInfo;\n  const frontier: Node[] = [];\n  const
inputNodes = Object.keys(inputs)\n    .map(name => parseNodeName(name)[0])\n
.map(name => graph.nodes[name]);\n  const initNodes = graph.initNodes;\n\n  inputNodes.forEach(input => {\n  if
(usedNodes.has(input.name)) {\n    frontier.push(input);\n  }\n });\n  graph.weights.forEach(weight => {\n  if
(usedNodes.has(weight.name)) {\n    frontier.push(weight);\n  }\n });\n  if (initNodes != null) {\n
initNodes.forEach(node => {\n  if (usedNodes.has(node.name)) {\n    frontier.push(node);\n  }\n });\n }\n
const seen = new Set<string>();\n  const orderedNodes: Node[] = [];\n  while (frontier.length > 0) {\n    const node =
frontier.pop();\n    seen.add(node.name);\n    if (!weightMap[node.name]) {\n      orderedNodes.push(node);\n    }\n
node.children.forEach(child => {\n    if (!seen.has(child.name) && usedNodes.has(child.name) &&\n

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child.inputs.every(input => seen.has(input.name))) {\n    frontier.push(child);\n    }\n  });\n }\n return
orderedNodes;\n}\n\nconst CONTROL_FLOW_OPS = [\n 'Switch', 'Merge', 'Enter', 'Exit', 'NextIteration',
'StatelessIf',\n 'StatelessWhile', 'if', 'While'\n];\nconst DYNAMIC_SHAPE_OPS = [\n 'NonMaxSuppressionV2',
'NonMaxSuppressionV3', 'NonMaxSuppressionV5', 'Where'\n];\nconst HASH_TABLE_OPS = [\n 'HashTable',
'HashTableV2', 'LookupTableImport', 'LookupTableImportV2',\n 'LookupTableFind',
'LookupTableFindV2'\n];\n\nexport function isControlFlow(node: Node) {\n return
CONTROL_FLOW_OPS.indexOf(node.op) >= 0;\n}\n\nexport function isDynamicShape(node: Node) {\n return
DYNAMIC_SHAPE_OPS.indexOf(node.op) >= 0;\n}\n\nexport function isHashTable(node: Node) {\n return
HASH_TABLE_OPS.indexOf(node.op) >= 0;\n}\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {DataType, NamedTensorMap, Tensor, tidy, util} from '@tensorflow/tfjs-core';\n\nimport
{ISignatureDef} from '../data/compiled_api';\n\nimport {NamedTensorsMap, TensorArrayMap, TensorInfo,
TensorListMap} from '../data/types';\n\nimport {getNodeNameAndIndex, getParamValue, getTensor,
getTensorsForCurrentContenxt, parseNodeName} from '../operations/executors/utils';\n\nimport {executeOp} from
 '../operations/operation_executor';\n\nimport {Graph, Node} from '../operations/types';\n\nimport {ExecutionContext,
ExecutionContextInfo} from './execution_context';\n\nimport {getExecutionSubgraph, getNodesInTopologicalOrder,
isControlFlow} from './model_analysis';\n\nimport {ResourceManager} from './resource_manager';\n\nimport
{FunctionExecutor} from './types';\n\ninterface NodeWithContexts {\n contexts: ExecutionContextInfo[];\n node:
Node;\n}\n\nexport class GraphExecutor implements FunctionExecutor {\n private compiledMap: Map<string,
Node[]> = new Map();\n private _weightMap: NamedTensorsMap = {};\n private _weightIds: number[];\n private
_signature: ISignatureDef;\n private _inputs: Node[];\n private _outputs: Node[];\n private _initNodes: Node[]; //
Internal init nodes to start initialization.\n private SEPERATOR = ',';\n private _functions: {[key: string]: Graph} =
{};\n private _functionExecutorMap: {[key: string]: FunctionExecutor} = {};\n private _resourceManager:
ResourceManager;\n\n get weightIds(): number[] {\n return this.parent ? this.parent.weightIds : this._weightIds;\n
}\n\n get functionExecutorMap(): {[key: string]: FunctionExecutor} {\n return this.parent ?
this.parent.functionExecutorMap :\n this._functionExecutorMap;\n }\n\n get weightMap():
NamedTensorsMap {\n return this.parent ? this.parent.weightMap : this._weightMap;\n }\n\n set
weightMap(weightMap: NamedTensorsMap) {\n const weightIds = Object.keys(weightMap).map(\n key =>
weightMap[key].map(tensor => tensor.id);\n this._weightIds = [].concat(...weightIds);\n this._weightMap =
weightMap;\n }\n\n /**\n * Set `ResourceManager` shared by executors of a model.\n * @param
resourceManager: `ResourceManager` of the `GraphModel`.\n */\n set resourceManager(resourceManager:
ResourceManager) {\n this._resourceManager = resourceManager;\n }\n\n get inputs(): TensorInfo[] {\n return
this._inputs.map(node => {\n return {\n name: node.name,\n shape: node.attrParams['shape'] ?\n
node.attrParams['shape'].value as number[] :\n undefined,\n dtype: node.attrParams['dtype'] ?\n
node.attrParams['dtype'].value as DataType :\n undefined\n };n });\n }\n\n get outputs(): TensorInfo[]
{\n return this._outputs.map(node => {\n return {\n name: node.name,\n shape:
node.attrParams['shape'] ?\n node.attrParams['shape'].value as number[] :\n undefined,\n dtype:
node.attrParams['dtype'] ?\n node.attrParams['dtype'].value as DataType :\n undefined\n };n });\n
}\n\n get inputNodes(): string[] {\n return this._inputs.map(node => node.signatureKey || node.name);\n }\n\n
get outputNodes(): string[] {\n return this._outputs.map((node) => {\n const name = node.signatureKey ||
node.name;\n return node.defaultOutput ? (`${name}:${node.defaultOutput}`) : name;\n });\n }\n\n get
functions(): {[key: string]: ISignatureDef} {\n return Object.keys(this._functions).reduce((map, key) => {\n

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map[key] = this._functions[key].signature;\n    return map;\n  }, { } as {[key: string]: ISignatureDef});\n\n\n/**\n * @param graph Graph the model or function graph to be executed.\n * @param parent When building\n function executor you need to set the parent\n * executor. Since the weights and function executor maps are set at\n parant\n * level, that function executor can access the function maps and weight maps\n * through the parent.\n */\n constructor(private graph: Graph, private parent?: GraphExecutor) {\n  this._outputs = graph.outputs;\n  this._inputs = graph.inputs;\n  this._initNodes = graph.initNodes;\n  this._signature = graph.signature;\n  this._functions = graph.functions;\n  // create sub-graph executors\n  if (graph.functions != null) {\n    Object.keys(graph.functions).forEach(name => {\n      this._functionExecutorMap[name] =\n        new\n        GraphExecutor(graph.functions[name], this);\n    });\n  }\n\n  private getCompilationKey(inputs: Node[],\n    outputs: Node[]): string {\n    const sortedInputs = inputs.map(node => node.name).sort();\n    const sortedOutputs =\n    outputs.map(node => node.name).sort();\n    return sortedInputs.join(this.SEPERATOR) + '--' +\n    sortedOutputs.join(this.SEPERATOR);\n  }\n\n  /**\n   * Compiles the inference graph and returns the minimal set\n   of nodes that are\n   * required for execution, in the correct execution order.\n   */\n  private compile(inputs:\n    NamedTensorMap, outputs: Node[]): Node[] {\n    const executionInfo =\n      getExecutionSubgraph(inputs,\n    outputs, this.weightMap, this._initNodes);\n    const {missingInputs, dynamicNode, syncInputs} = executionInfo;\n    if (dynamicNode != null) {\n      throw new Error(\n        `This execution contains the node\n        '${dynamicNode.name}', which has\n        `the dynamic op '${dynamicNode.op}'. Please use\n        `model.executeAsync() instead. Alternatively, to avoid the\n        `dynamic ops, specify the inputs\n        [${syncInputs}]`);\n    }\n    if (missingInputs.length > 0) {\n      const outNames = outputs.map(n => n.name);\n      const inNames = Object.keys(inputs);\n      throw new Error(\n        `Cannot compute the outputs [${outNames}]\n        from the provided inputs\n        [${inNames}]. Missing the following inputs: [${missingInputs}]`);\n    }\n    return getNodesInTopologicalOrder(\n      this.graph, this.weightMap, executionInfo);\n  }\n\n  /**\n   * Executes\n   the inference for given input tensors.\n   * @param inputs Tensor map for the model inputs, keyed by the input\n   node\n   * names.\n   * @param outputs Optional. output node name from the Tensorflow model, if\n   * no outputs\n   are specified, the default outputs of the model would be used.\n   * You can inspect intermediate nodes of the model\n   by adding them to the\n   * outputs array.\n   */\n  execute(inputs: NamedTensorMap, outputs?: string[]): Tensor[]\n  {\n    inputs = this.mapInputs(inputs);\n    const names = Object.keys(inputs).sort();\n    this.checkInputs(inputs);\n    this.checkInputShapeAndType(inputs);\n    outputs = this.mapOutputs(outputs);\n    this.checkOutputs(outputs);\n    const inputNodes =\n      names.map(name => this.graph.nodes[parseNodeName(name)[0]]);\n    const\n    outputNodeNames = outputs.map(name => parseNodeName(name)[0]);\n    let outputNodes =\n    outputNodeNames.map(name => this.graph.nodes[name]);\n    // If no outputs are specified, then use the default\n    outputs of the model.\n    if (outputNodes.length === 0) {\n      outputNodes = this._outputs;\n    }\n    const\n    compilationKey = this.getCompilationKey(inputNodes, outputNodes);\n    // Do nothing if the compiled graph\n    cache contains the input.\n    let orderedNodes = this.compiledMap.get(compilationKey);\n    if (orderedNodes ==\n    null) {\n      orderedNodes = this.compile(inputs, outputNodes);\n      this.compiledMap.set(compilationKey,\n    orderedNodes);\n    }\n    const tensorArrayMap: TensorArrayMap = {};\n    const tensorListMap: TensorListMap\n    = {};\n    return tidy(() => {\n      const context = new ExecutionContext(\n        this.weightMap,\n    tensorArrayMap, tensorListMap,\n        this.functionExecutorMap);\n      const tensorsMap: NamedTensorsMap =\n    {...this.weightMap};\n      Object.keys(inputs).forEach(name => {\n        const [nodeName, index] =\n        parseNodeName(name);\n        const tensors: Tensor[] = [];\n        tensors[index] = inputs[name];\n        tensorsMap[nodeName] = tensors;\n      });\n      const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n      const intermediateTensorConsumerCount: {[key: number]: number} = {};\n      for (let i = 0; i <\n    orderedNodes.length; i++) {\n        const node = orderedNodes[i];\n        if (!tensorsMap[node.name]) {\n          const\n          tensors =\n            executeOp(node, tensorsMap, context, this._resourceManager) as\n            Tensor[];\n          if\n          (util.isPromise(tensors)) {\n            throw new Error(\n              `The execution of the op '${node.op}' returned a\n              promise.\n              `Please use model.executeAsync() instead.`);\n          }\n          tensorsMap[node.name] =\n          tensors;\n          this.checkTensorForDisposal(\n            node.name, node, tensorsMap, context, tensorsToKeep,\n            outputNodeNames, intermediateTensorConsumerCount);\n        }\n      }\n      // dispose the context for the root

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executor\n    if (this.parent == null) {\n        context.dispose(tensorsToKeep);\n    }\n    return outputs.map(name
=> getTensor(name, tensorsMap, context));\n    });\n    }\n\n    private getFrozenTensorIds(tensorMap:
NamedTensorsMap): Set<number> {\n        const ids = [].concat.apply(\n            [],\n            Object.keys(tensorMap)\n                .map(key => tensorMap[key])\n                .map(tensors => tensors.map(tensor => tensor.id));\n        return new
Set(ids);\n    }\n\n    private checkTensorForDisposal(\n        nodeName: string, node: Node, tensorMap:
NamedTensorsMap,\n        context: ExecutionContext, tensorsToKeep: Set<number>,\n        outputNames: string[],\n        intermediateTensorConsumerCount: {[key: string]: number}) {\n        // Skip output nodes and any control flow
nodes, since its dependency is\n        // tricky to track correctly.\n        if (node.category === 'control' ||
outputNames.indexOf(nodeName) !== -1) {\n            return;\n        }\n        tensorMap[nodeName].forEach(tensor => {\n
if (tensor != null) {\n            intermediateTensorConsumerCount[tensor.id] =\n
(intermediateTensorConsumerCount[tensor.id] || 0) +\n                node.children.length;\n            }\n        });\n        node.inputs.forEach(input => {\n            // Skip any control flow nodes, since its dependency is tricky to track\n            //
correctly.\n            if (input.category !== 'control') {\n                const tensors =\n
getTensorsForCurrentContent(input.name, tensorMap, context);\n                if (tensors != null) {\n
tensors.forEach(tensor => {\n                    if (tensor && !tensorsToKeep.has(tensor.id)) {\n                        const count =
intermediateTensorConsumerCount[tensor.id];\n                        if (count === 1) {\n                            tensor.dispose();\n
delete intermediateTensorConsumerCount[tensor.id];\n                        } else if (count != null) {\n                            // only
intermediate nodes has count set, inputs and weights are\n                            // not.\n
intermediateTensorConsumerCount[tensor.id]--;\n                        }\n                    });\n                });\n            });\n        });\n    }\n\n    /**\n     * Executes the inference for given input tensors in Async fashion.\n     * @param inputs Tensor map for the
model inputs, keyed by the input node\n     * names.\n     * @param outputs output node name from the Tensorflow
model, if no outputs\n     * are specified, the default outputs of the model would be used. You can\n     * inspect
intermediate nodes of the model by adding them to the outputs\n     * array.\n     * ^\n     * async executeAsync(inputs:
NamedTensorMap, outputs?: string[]):\n     * Promise<Tensor[]> {\n     * return this._executeAsync(inputs, outputs);\n     * }\n     * }\n\n     * Executes the inference for given input tensors in Async fashion.\n     * @param inputs Tensor map for
the model inputs, keyed by the input node\n     * names.\n     * @param outputs Optional. output node name from the
Tensorflow model,\n     * if no outputs are specified, the default outputs of the model would be\n     * used. You can
inspect intermediate nodes of the model by adding them to the\n     * outputs array.\n     * @param
isFunctionExecution Optional. Flag for executing a function.\n     * @param tensorArrayMap Optional, global
TensorArray map by id. Used for\n     * function execution.\n     * @param tensorArrayMap Optinal global TensorList
map by id. Used for\n     * function execution.\n     * ^\n     * private async _executeAsync(\n     * inputs: NamedTensorMap,
outputs?: string[], isFunctionExecution = false,\n     * tensorArrayMap: TensorArrayMap = {},\n     * tensorListMap:
TensorListMap = {}): Promise<Tensor[]> {\n     * if (!isFunctionExecution) {\n     * inputs = this.mapInputs(inputs);\n
this.checkInputs(inputs);\n     * this.checkInputShapeAndType(inputs);\n     * outputs = this.mapOutputs(outputs);\n
this.checkOutputs(outputs);\n     * }\n     * }\n     * const context = new ExecutionContext(\n     * this.weightMap,
tensorArrayMap, tensorListMap,\n     * this.functionExecutorMap);\n     * }\n     * // Graph with control flow op requires
runtime evaluation of the execution\n     * // order, while without control flow the execution order is pre-determined\n
// in the compile method.\n     * const tensorMap = await this.executeWithControlFlow(\n     * inputs, context, outputs,
isFunctionExecution);\n     * const results = outputs.map(name => getTensor(name, tensorMap, context));\n     * }\n     * //
dispose all the intermediate tensors\n     * const outputIds = results.map(t => t.id);\n     * const inputIds =
Object.keys(inputs).map(name => inputs[name].id);\n     * const keepIds =\n     * new Set<number>([...outputIds,
...inputIds, ...this.weightIds]);\n     * Object.keys(tensorMap).forEach(key => {\n     * const tensorArray =
tensorMap[key];\n     * tensorArray.forEach(tensor => {\n     * if (tensor && !tensor.isDisposed &&
!keepIds.has(tensor.id)) {\n     * tensor.dispose();\n     * }\n     * });\n     * });\n     * // dispose the context for the root
executor\n     * if (this.parent == null) {\n     * context.dispose(keepIds);\n     * }\n     * return results;\n     * }\n     * }\n     * async
executeFunctionAsync(\n     * inputs: Tensor[], tensorArrayMap: TensorArrayMap,\n     * tensorListMap:
TensorListMap): Promise<Tensor[]> {\n     * const mappedInputs = inputs.reduce((map, tensor, index) => {\n     * map[this.inputs[index].name] = tensor;\n
return map;\n     * }, {} as NamedTensorMap);\n     * }\n     * return

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this._executeAsync(\n    mappedInputs, this.outputNodes, true, tensorArrayMap, tensorListMap);\n } \n /**\n *
When there are control flow nodes in the graph, the graph execution use\n * ExecutionContext to keep track of the
frames and loop iterators.\n * @param inputs placeholder tensors for the graph.\n * @param context the execution
context object for current execution.\n * @param outputNames Optional. output node name from the Tensorflow
model,\n * if no outputs are specified, the default outputs of the model would be\n * used. You can inspect
intermediate nodes of the model by adding them to the\n * outputs array.\n * @param isFunctionExecution Flag
for executing a function.\n */\n private async executeWithControlFlow(\n    inputs: NamedTensorMap, context:
ExecutionContext, outputNames?: string[],\n    isFunctionExecution?: boolean): Promise<NamedTensorsMap> {\n
    const names = Object.keys(inputs);\n    const inputNodes =\n        names.map(name =>
this.graph.nodes[parseNodeName(name)[0]]);\n    const outputNodeNames = outputNames.map(name =>
parseNodeName(name)[0]);\n    let outputNodes = outputNodeNames.map(name => this.graph.nodes[name]);\n\n
// If no outputs are specified, then use the default outputs of the model.\n    if (outputNodes.length === 0) {\n
outputNodes = this._outputs;\n    }\n\n    const {usedNodes, missingInputs, dynamicNode, syncInputs} =\n        getExecutionSubgraph(\n            inputs, outputNodes, this.weightMap, this._initNodes);\n\n    // First nodes to
execute include inputNodes, weights, and initNodes.\n    const stack: NodeWithContexts[] = [\n        ...inputNodes,
...this.graph.weights, ...(this._initNodes || [])\n    ].map(node => {\n        return {node, contexts:
context.currentContext};\n    });\n    const tensorsMap: NamedTensorsMap = {...this.weightMap};\n
Object.keys(inputs).forEach(name => {\n        const [nodeName, index] = parseNodeName(name);\n        const
tensors: Tensor[] = [];\n        tensors[index] = inputs[name];\n        tensorsMap[nodeName] = tensors;\n    });\n    const
intermediateTensorConsumerCount: {[key: number]: number} = {};\n    const tensorsToKeep =
this.getFrozenTensorIds(tensorsMap);\n    const added: {[key: string]: boolean} = {};\n    while (stack.length > 0)
{\n        const promises = this.processStack(\n            inputNodes, stack, context, tensorsMap, added, tensorsToKeep,\n
            outputNodeNames, intermediateTensorConsumerCount, usedNodes);\n        await Promise.all(promises);\n    }\n
    if (dynamicNode == null && !isFunctionExecution) {\n        console.warn(\n            `This model execution did not
contain any nodes with control flow ` +\n            `or dynamic output shapes. You can use model.execute()
instead.`);\n    }\n    const missingOutputs =\n        outputNodes\n            .filter(\n                node =>
!isControlFlow(node) &&\n                    !getTensor(node.name, tensorsMap, context))\n            .map(node =>
node.name);\n    if (missingOutputs.length > 0) {\n        let alternativeMsg = `;\n        if (dynamicNode != null) {\n
alternativeMsg =\n            `Alternatively, to avoid the dynamic ops, use model.execute() ` +\n            `and specify
the inputs [${syncInputs}]`;\n        }\n        throw new Error(\n            `Cannot compute the outputs [${missingOutputs}]
from the provided ` +\n            `inputs [${names}]. Consider providing the following inputs: ` +\n
            `[${missingInputs}]. ${alternativeMsg}`);\n    }\n    return tensorsMap;\n } \n\n private processStack(\n
inputNodes: Node[], stack: NodeWithContexts[], context: ExecutionContext,\n    tensorMap: NamedTensorsMap,
added: {[key: string]: boolean},\n    tensorsToKeep: Set<number>, outputNames: string[],\n
intermediateTensorConsumerCount: {[key: number]: number},\n    usedNodes: Set<string>) {\n    const promises:
Array<Promise<Tensor[]>> = [];\n    while (stack.length > 0) {\n        const item = stack.pop();\n
context.currentContext = item.contexts;\n        let nodeName = `;\n        // The tensor of the Enter op with isConstant
set should be set\n        // in the parent scope, so it will be available as constant for the\n        // whole loop.\n        if
(item.node.op === 'Enter' &&\n            getParamValue('isConstant', item.node, tensorMap, context)) {\n
[nodeName] = getNodeNameAndIndex(item.node.name, context);\n        }\n\n        // only process nodes that are not in
the tensorMap yet, this include\n        // inputNodes and internal initNodes.\n        if (tensorMap[item.node.name] ==
null) {\n            const tensors =\n                executeOp(item.node, tensorMap, context, this._resourceManager);\n            if
(!nodeName) {\n                [nodeName] = getNodeNameAndIndex(item.node.name, context);\n            }\n            const
currentContext = context.currentContext;\n            if (util.isPromise(tensors)) {\n                promises.push((tensors as
Promise<Tensor[]>).then(t => {\n                    tensorMap[nodeName] = t;\n                    context.currentContext =
currentContext;\n                    this.checkTensorForDisposal(\n                        nodeName, item.node, tensorMap, context,
tensorsToKeep,\n                        outputNames, intermediateTensorConsumerCount);\n                    this.processChildNodes(\n
                        item.node, stack, context, tensorMap, added, usedNodes);\n                    return t;\n                }));\n            } else {\n

```

```

tensorMap[nodeName] = tensors as Tensor[];
this.checkTensorForDisposal(\n      nodeName,
item.node, tensorMap, context, tensorsToKeep,\n      outputNames, intermediateTensorConsumerCount);
this.processChildNodes(\n      item.node, stack, context, tensorMap, added, usedNodes);\n  }\n  } else {\n    this.processChildNodes(\n      item.node, stack, context, tensorMap, added, usedNodes);\n  }\n}\nreturn promises;\n}\n\nprivate processChildNodes(\n  node: Node, stack: NodeWithContexts[], context:
ExecutionContext,\n  tensorMap: NamedTensorsMap, added: {[key: string]: boolean},\n  usedNodes:
Set<string>) {\n  node.children.forEach((childNode) => {\n    const [nodeName, ] =
getNodeNameAndIndex(childNode.name, context);\n    if (added[nodeName] || !usedNodes.has(childNode.name))
{\n      return;\n    }\n    // Merge op can be pushed if any of its inputs has value.\n    if (childNode.op ===
'Merge') {\n      if (childNode.inputNames.some(name => {\n        return !!getTensor(name, tensorMap,
context);\n      })) {\n        added[nodeName] = true;\n        stack.push({ contexts: context.currentContext,
node: childNode});\n      }\n    } else // Otherwise all inputs must to have value.\n      if
(childNode.inputNames.every(name => {\n        return !!getTensor(name, tensorMap, context);\n      }))
{\n        added[nodeName] = true;\n        stack.push({ contexts: context.currentContext, node: childNode});\n      }\n    }\n  });\n}\n\n/**\n * Releases the memory used by the weight tensors.\n */\ndispose() {\n
Object.keys(this.weightMap)\n  .forEach(\n    key => this.weightMap[key].forEach(tensor =>
tensor.dispose());\n}\n\nprivate checkInputShapeAndType(inputs: NamedTensorMap) {\n
Object.keys(inputs).forEach(name => {\n  const input = inputs[name];\n  const [nodeName, ] =
parseNodeName(name);\n  const node = this.graph.nodes[nodeName];\n  if (node.attrParams['shape'] &&
node.attrParams['shape'].value) {\n    const shape = node.attrParams['shape'].value as number[];\n    const
match = shape.length === input.shape.length &&\n      input.shape.every(\n        (dim, index) =>
shape[index] === -1 || shape[index] === dim);\n    util.assert(\n      match,\n      () => `The shape of
dict['${node.name}'] provided in ` +\n        `model.execute(dict) must be [${shape}], but was ` +\n
`${input.shape}`);\n  }\n  if (node.attrParams['dtype'] && node.attrParams['dtype'].value) {\n
util.assert(\n      input.dtype === node.attrParams['dtype'].value as string,\n      () => `The dtype of
dict['${node.name}'] provided in ` +\n        `model.execute(dict) must be ` +\n
`${node.attrParams['dtype'].value}, but was ${input.dtype}`);\n  }\n});\n}\n\nprivate mapInputs(inputs:
NamedTensorMap) {\n  const result: NamedTensorMap = {};\n  for (const inputName in inputs) {\n    if
(this._signature !== null && this._signature.inputs !== null &&\n      this._signature.inputs[inputName] !== null) {\n
const tensor = this._signature.inputs[inputName];\n      result[tensor.name] = inputs[inputName];\n    } else {\n
result[inputName] = inputs[inputName];\n    }\n  }\n  return result;\n}\n\nprivate checkInputs(inputs:
NamedTensorMap) {\n  const notInGraph = Object.keys(inputs).filter(name => {\n    const [nodeName] =
parseNodeName(name);\n    return this.graph.nodes[nodeName] == null;\n  });\n  if (notInGraph.length > 0) {\n
throw new Error(\n    `The dict provided in model.execute(dict) has ` +\n    `keys: [${notInGraph}] that are
not part of graph`);\n  }\n}\n\nprivate mapOutputs(outputs: string[]) {\n  return outputs.map(name => {\n
if (this._signature !== null && this._signature.outputs !== null &&\n      this._signature.outputs[name] !== null) {\n
const tensor = this._signature.outputs[name];\n      return tensor.name;\n    }\n    return name;\n  }, {});\n}\n\nprivate checkOutputs(outputs: string[]): void {\n  outputs.forEach(name => {\n    const [normalizedName] =
parseNodeName(name);\n    if (!this.graph.nodes[normalizedName]) {\n      throw new Error(`The output
'${name}' is not found in the graph`);\n    }\n  });\n}\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
=====
*/\nimport {HashMap, NamedTensorMap} from './data/types';\nimport {HashMap} from

```

```

'./hash_table';\n\n/**\n * Contains global resources of a model.\n */\nexport class ResourceManager {\n
  constructor(\n    readonly hashTableNameToHandle: NamedTensorMap = {},\n    readonly hashTableMap:\n
  HashTableMap = {}) {\n\n    /**\n     * Register a `HashTable` in the resource manager.\n     *\n     * The `HashTable`\n
  can be retrieved by `resourceManager.getHashTableById`,\n     * where id is the table handle tensor's id.\n     *\n     *\n
  @param name Op node name that creates the `HashTable`.\n     * @param hashTable The `HashTable` to be added to\n
  resource manager.\n     */\n    addHashTable(name: string, hashTable: HashTable) {\n\n
  this.hashTableNameToHandle[name] = hashTable.handle;\n    this.hashTableMap[hashTable.id] = hashTable;\n
  }\n\n    /**\n     * Get the table handle by node name.\n     * @param name Op node name that creates the `HashTable`.\n
  This name is also\n     * used in the inputs list of lookup and import `HashTable` ops.\n     */\n
  getHashTableHandleByName(name: string) {\n    return this.hashTableNameToHandle[name];\n  }\n\n    /**\n     * Get the actual `HashTable` by its handle tensor's id.\n     * @param id The id of the handle tensor.\n     */\n
  getHashTableById(id: number): HashTable {\n    return this.hashTableMap[id];\n  }\n\n    /**\n     * Dispose\n
  `ResourceManager`, including its hashTables and tensors in them.\n     */\n    dispose() {\n    for (const key in\n
  this.hashTableMap) {\n    this.hashTableMap[key].clearAndClose();\n    delete this.hashTableMap[key];\n  }\n\n
  for (const name in this.hashTableNameToHandle) {\n    this.hashTableNameToHandle[name].dispose();\n
  delete this.hashTableNameToHandle[name];\n  }\n  }\n\n  },\n  /**\n   * @license\n   * Copyright 2018 Google LLC.\n
  All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the `License`);\n   * you may not use this\n
  file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * \n
  http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing,\n
  software\n   * distributed under the License is distributed on an `AS IS` BASIS,\n   * WITHOUT WARRANTIES\n
  OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language\n
  governing permissions and\n   * limitations under the License.\n   */\n  }\n\n  =====\n
  *\n  \nimport {InferenceModel, io, ModelPredictConfig, NamedTensorMap, Tensor} from '@tensorflow/tfjs-\n
  core';\nimport * as tensorflow from './data/compiled_api';\nimport {NamedTensorsMap, TensorInfo} from\n
  './data/types';\nimport {OperationMapper} from './operations/operation_mapper';\nimport {GraphExecutor} from\n
  './graph_executor';\nimport {ResourceManager} from './resource_manager';\n\nexport const\n
  TFHUB_SEARCH_PARAM = '?tfjs-format=file';\nexport const DEFAULT_MODEL_NAME =\n
  'model.json';\n\n/**\n * A `tf.GraphModel` is a directed, acyclic graph built from a\n * SavedModel GraphDef and\n
  allows inference execution.\n * \n * A `tf.GraphModel` can only be created by loading from a model converted\n
  from\n * a [TensorFlow SavedModel](https://www.tensorflow.org/guide/saved_model) using\n * the command line\n
  converter tool and loaded via `tf.loadGraphModel`.\n * \n * @doc {heading: 'Models', subheading: 'Classes'}\n
  *\n  \nexport class GraphModel implements InferenceModel {\n  private executor: GraphExecutor;\n  private version =\n
  'n/a';\n  private handler: io.IOHandler;\n  private artifacts: io.ModelArtifacts;\n  private initializer: GraphExecutor;\n
  private resourceManager: ResourceManager;\n  private signature: tensorflow.ISignatureDef;\n\n  // Returns the\n
  version information for the tensorflow model GraphDef.\n  get modelVersion(): string {\n    return this.version;\n
  }\n\n  get inputNodes(): string[] {\n    return this.executor.inputNodes;\n  }\n\n  get outputNodes(): string[] {\n
  return this.executor.outputNodes;\n  }\n\n  get inputs(): TensorInfo[] {\n    return this.executor.inputs;\n  }\n\n
  get outputs(): TensorInfo[] {\n    return this.executor.outputs;\n  }\n\n  get weights(): NamedTensorsMap {\n    return\n
  this.executor.weightMap;\n  }\n\n  get metadata(): {} {\n    return this.artifacts.userDefinedMetadata;\n  }\n\n
  get\n  modelSignature(): {} {\n    return this.signature;\n  }\n\n  /**\n   * @param modelUrl url for the model, or an\n
  `io.IOHandler`.\n   * @param weightManifestUrl url for the weight file generated by\n   * scripts/convert.py\n
  script.\n   * @param requestOptions options for Request, which allows to send credentials\n   * and custom\n
  headers.\n   * @param onProgress Optional, progress callback function, fired periodically\n   * before the load is\n
  completed.\n   */\n  constructor(\n    private modelUrl: string|io.IOHandler,\n    private loadOptions:\n
  io.LoadOptions = {}) {\n    if (loadOptions == null) {\n    this.loadOptions = {};\n  }\n\n    this.resourceManager =\n
  new ResourceManager();\n  }\n\n  private findIOHandler() {\n    const path = this.modelUrl;\n    if ((path as\n
  io.IOHandler).load != null) {\n    // Path is an IO Handler.\n    this.handler = path as io.IOHandler;\n  } else if

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(this.loadOptions.requestInit != null) {\n    this.handler = io.browserHTTPRequest(path as string,
this.loadOptions);\n  } else {\n    const handlers = io.getLoadHandlers(path as string, this.loadOptions);\n    if
(handlers.length === 0) {\n      // For backward compatibility: if no load handler can be found,\n      // assume it is
a relative http path.\n      handlers.push(io.browserHTTPRequest(path as string, this.loadOptions));\n    } else if
(handlers.length > 1) {\n      throw new Error(\n        `Found more than one (${handlers.length}) load handlers
for ` +\n        `URL '${[path]}'`);\n    }\n    this.handler = handlers[0];\n  }\n}\n\n/**\n * Loads the model
and weight files, construct the in memory weight map and\n * compile the inference graph.\n */\n async load():
Promise<boolean> {\n  this.findIOHandler();\n  if (this.handler.load == null) {\n    throw new Error(\n
'Cannot proceed with model loading because the IOHandler provided ' +\n    'does not have the `load` method
implemented.);\n  }\n  const artifacts = await this.handler.load();\n  return this.loadSync(artifacts);\n}\n\n
/**\n * Synchronously construct the in memory weight map and\n * compile the inference graph. Also initialize
hashtable if any.\n */\n * @doc {heading: 'Models', subheading: 'Classes', ignoreCI: true}\n */\n
loadSync(artifacts: io.ModelArtifacts) {\n  this.artifacts = artifacts;\n  const graph = this.artifacts.modelTopology
as tensorflow.IGraphDef;\n\n  let signature;\n  if (this.artifacts.userDefinedMetadata != null &&\n
this.artifacts.userDefinedMetadata.signature != null) {\n    signature = // tslint:disable-next-line:no-any\n
(this.artifacts.userDefinedMetadata as any).signature as\n    tensorflow.ISignatureDef;\n  } else {\n    signature
= this.artifacts.signature;\n  }\n  this.signature = signature;\n\n  this.version =
`${graph.versions.producer}.${graph.versions.minConsumer}`;\n  const weightMap =\n
io.decodeWeights(this.artifacts.weightData, this.artifacts.weightSpecs);\n  this.executor = new GraphExecutor(\n
  OperationMapper.Instance.transformGraph(graph, this.signature);\n  this.executor.weightMap =
this.convertTensorMapToTensorsMap(weightMap);\n  // Attach a model-level resourceManager to each executor
to share resources,\n  // such as `HashTable`\n  this.executor.resourceManager = this.resourceManager;\n\n  if
(artifacts.modelInitializer != null &&\n    (artifacts.modelInitializer as tensorflow.IGraphDef).node != null) {\n
const initializer =\n    OperationMapper.Instance.transformGraph(artifacts.modelInitializer);\n    this.initializer
= new GraphExecutor(initializer);\n    this.initializer.weightMap = this.executor.weightMap;\n    // Attach a
model-level resourceManager to the initializer, the\n    // hashTables created from when executing the initializer
will be stored\n    // in the resourceManager.\n    this.initializer.resourceManager = this.resourceManager;\n
this.initializer.executeAsync({}, []);\n  }\n\n  return true;\n}\n\n/**\n * Save the configuration and/or weights
of the GraphModel.\n */\n * An `IOHandler` is an object that has a `save` method of the proper\n * signature
defined. The `save` method manages the storing or\n * transmission of serialized data ("artifacts") that represent
the\n * model's topology and weights onto or via a specific medium, such as\n * file downloads, local storage,
IndexedDB in the web browser and HTTP\n * requests to a server. TensorFlow.js provides `IOHandler`\n *
implementations for a number of frequently used saving mediums, such as\n * `tf.io.browserDownloads` and
`tf.io.browserLocalStorage`. See `tf.io`\n * for more details.\n */\n * This method also allows you to refer to
certain types of `IOHandler`s\n * as URL-like string shortcuts, such as `localStorage://` and\n * `indexeddb://`.\n
*\n * Example 1: Save `model`'s topology and weights to browser [local\n *
storage](https://developer.mozilla.org/en-US/docs/Web/API/Window/LocalStorage);\n * then load it back.\n */\n
*\n * ```js\n * const modelUrl =\n *   'https://storage.googleapis.com/tfjs-
models/savedmodel/mobilenet_v2_1.0_224/model.json';\n * const model = await tf.loadGraphModel(modelUrl);\n
*\n * const zeros = tf.zeros([1, 224, 224, 3]);\n * model.predict(zeros).print();\n *\n * const saveResults = await
model.save('localStorage://my-model-1');\n *\n * const loadedModel = await
tf.loadGraphModel('localStorage://my-model-1');\n * console.log('Prediction from loaded model:');\n *\n
model.predict(zeros).print();\n * ```\n */\n * @param handlerOrURL An instance of `IOHandler` or a URL-
like,\n * scheme-based string shortcut for `IOHandler`.\n * @param config Options for saving the model.\n *
@returns A `Promise` of `SaveResult`, which summarizes the result of\n * the saving, such as byte sizes of the
saved artifacts for the model's\n * topology and weight values.\n */\n * @doc {heading: 'Models', subheading:
'Classes', ignoreCI: true}\n */\n async save(handlerOrURL: io.IOHandler|string, config?: io.SaveConfig):
Promise<io.SaveResult> {\n  if (typeof handlerOrURL === 'string') {\n    const handlers =

```



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io.getSaveHandlers(handlerOrURL);\n    if (handlers.length === 0) {\n        throw new Error(\n            `Cannot find\n            any save handlers for URL '${handlerOrURL}'`);\n    } else if (handlers.length > 1) {\n        throw new Error(\n            `Found more than one (${handlers.length}) save handlers for `+\n            `URL '${handlerOrURL}'`);\n    }\n    handlerOrURL = handlers[0];\n }\n if (handlerOrURL.save === null) {\n    throw new Error(\n        'GraphModel.save() cannot proceed because the IOHandler ' +\n        'provided does not have the `save` attribute\n        defined.);\n }\n\n return handlerOrURL.save(this.artifacts);\n }\n\n /**\n  * Execute the inference for the input\n  tensors.\n  *\n  * @param input The input tensors, when there is single input for the model,\n  * inputs param\n  should be a `tf.Tensor`. For models with mutliple inputs,\n  * inputs params should be in either `tf.Tensor[]` if the\n  input order is\n  * fixed, or otherwise NamedTensorMap format.\n  *\n  * For model with multiple inputs, we\n  recommend you use NamedTensorMap as the\n  * input type, if you use `tf.Tensor[]`, the order of the array needs\n  to\n  * follow the\n  * order of inputNodes array. @see {@link GraphModel.inputNodes}\n  *\n  * You can also\n  feed any intermediate nodes using the NamedTensorMap as the\n  * input type. For example, given the graph\n  *\n  InputNode => Intermediate => OutputNode,\n  * you can execute the subgraph Intermediate => OutputNode by\n  calling\n  * model.execute('IntermediateNode' : tf.tensor(...));\n  *\n  * This is useful for models that uses\n  tf.dynamic_rnn, where the intermediate\n  * state needs to be fed manually.\n  *\n  * For batch inference\n  execution, the tensors for each input need to be\n  * concatenated together. For example with mobilenet, the\n  required input shape\n  * is [1, 244, 244, 3], which represents the [batch, height, width, channel].\n  * If we are\n  provide a batched data of 100 images, the input tensor should be\n  * in the shape of [100, 244, 244, 3].\n  *\n  *\n  * @param config Prediction configuration for specifying the batch size and\n  * output node names. Currently the\n  batch size option is ignored for graph\n  * model.\n  *\n  * @returns Inference result tensors. The output would be\n  single `tf.Tensor`\n  * if model has single output node, otherwise Tensor[] or NamedTensorMap[]\n  * will be\n  returned for model with multiple outputs.\n  *\n  * @doc {heading: 'Models', subheading: 'Classes'}\n  */\n\n predict(inputs: Tensor|Tensor[]|NamedTensorMap, config?: ModelPredictConfig):\n  Tensor|Tensor[]|NamedTensorMap {\n    return this.execute(inputs, this.outputNodes);\n }\n\n private\n  normalizeInputs(inputs: Tensor|Tensor[]|n\n    NamedTensorMap): NamedTensorMap {\n    if (!(inputs\n  instanceof Tensor) && !Array.isArray(inputs)) {\n      // The input is already a NamedTensorMap.\n      return\n  inputs;\n    }\n    inputs = Array.isArray(inputs) ? inputs : [inputs];\n    if (inputs.length !== this.inputNodes.length)\n    {\n      throw new Error(\n        `Input tensor count mismatch, `+\n        `the graph model has\n  ${this.inputNodes.length} placeholders, `+\n        `while there are ${inputs.length} input tensors.`);\n    }\n    return this.inputNodes.reduce((map, inputName, i) => {\n      map[inputName] = (inputs as Tensor[])[i];\n      return\n  map;\n    }, {} as NamedTensorMap);\n  }\n\n private normalizeOutputs(outputs: string|string[]): string[] {\n  outputs = outputs || this.outputNodes;\n  return !Array.isArray(outputs) ? [outputs] : outputs;\n }\n\n /**\n  * Executes inference for the model for given input tensors.\n  *\n  * @param inputs tensor, tensor array or tensor map of\n  the inputs for the\n  * model, keyed by the input node names.\n  *\n  * @param outputs output node name from the\n  Tensorflow model, if no\n  * outputs are specified, the default outputs of the model would be used.\n  * You can\n  inspect intermediate nodes of the model by adding them to the\n  * outputs array.\n  *\n  * @returns A single\n  tensor if provided with a single output or no outputs\n  * are provided and there is only one default output,\n  otherwise return a\n  * tensor array. The order of the tensor array is the same as the outputs\n  * if provided,\n  otherwise the order of outputNodes attribute of the model.\n  *\n  * @doc {heading: 'Models', subheading:\n  'Classes'}\n  */\n\n execute(inputs: Tensor|Tensor[]|NamedTensorMap, outputs?: string|string[]):\n  Tensor|Tensor[] {\n    inputs = this.normalizeInputs(inputs);\n    outputs = this.normalizeOutputs(outputs);\n    const\n  result = this.executor.execute(inputs, outputs);\n    return result.length > 1 ? result : result[0];\n }\n\n /**\n  * Executes inference for the model for given input tensors in async\n  * fashion, use this method when your model\n  contains control flow ops.\n  *\n  * @param inputs tensor, tensor array or tensor map of the inputs for the\n  * model,\n  keyed by the input node names.\n  *\n  * @param outputs output node name from the Tensorflow model, if no outputs\n  *\n  * are specified, the default outputs of the model would be used. You can\n  * inspect intermediate nodes of the\n  model by adding them to the outputs\n  * array.\n  *\n  * @returns A Promise of single tensor if provided with a\n  single output or\n  * no outputs are provided and there is only one default output, otherwise\n  * return a tensor

```

```

map.\n *\n * @doc {heading: 'Models', subheading: 'Classes'}\n */\n async executeAsync(\n   inputs:
Tensor[Tensor[]]NamedTensorMap,\n   outputs?: string|string[]): Promise<Tensor[Tensor[]]> {\n   inputs =
this.normalizeInputs(inputs);\n   outputs = this.normalizeOutputs(outputs);\n   const result = await
this.executor.executeAsync(inputs, outputs);\n   return result.length > 1 ? result : result[0];\n } \n\n private
convertTensorMapToTensorsMap(map: NamedTensorMap): NamedTensorsMap {\n   return
Object.keys(map).reduce((newMap: NamedTensorsMap, key) => {\n     newMap[key] = [map[key]];\n     return
newMap;\n   }, {});\n } \n\n /**\n * Releases the memory used by the weight tensors and resourceManager.\n
*\n * @doc {heading: 'Models', subheading: 'Classes'}\n */\n dispose() {\n   this.executor.dispose();\n\n   if
(this.initializer) {\n     this.initializer.dispose();\n   }\n\n   this.resourceManager.dispose();\n } \n\n /**\n * Load
a graph model given a URL to the model definition.\n *\n * Example of loading MobileNetV2 from a URL and
making a prediction with a\n *\n * zeros input:\n *\n * ```js\n * const modelUrl =\n *
'https://storage.googleapis.com/tfjs-models/savedmodel/mobilenet_v2_1.0_224/model.json';\n * const model = await
tf.loadGraphModel(modelUrl);\n * const zeros = tf.zeros([1, 224, 224, 3]);\n * model.predict(zeros).print();\n * ```\n
*\n * Example of loading MobileNetV2 from a TF Hub URL and making a prediction with\n * a zeros input:\n *\n *
```js\n * const modelUrl =\n * 'https://tfhub.dev/google/imagenet/mobilenet_v2_140_224/classification/2';\n *
const model = await tf.loadGraphModel(modelUrl, {fromTFHub: true});\n * const zeros = tf.zeros([1, 224, 224,
3]);\n * model.predict(zeros).print();\n * ```\n *\n * @param modelUrl The url or an `io.IOHandler` that loads the
model.\n *\n * @param options Options for the HTTP request, which allows to send credentials\n * and custom
headers.\n *\n * @doc {heading: 'Models', subheading: 'Loading'}\n */\n\n export async function loadGraphModel(\n
 modelUrl: string|io.IOHandler,\n options: io.LoadOptions = {}): Promise<GraphModel> {\n if (modelUrl ==
null) {\n throw new Error(\n 'modelUrl in loadGraphModel() cannot be null. Please provide a url ' +\n 'or
an IOHandler that loads the model');\n }\n if (options == null) {\n options = {};\n }\n\n if (options.fromTFHub)
{\n if ((modelUrl as io.IOHandler).load == null) {\n if (!(modelUrl as string).endsWith('/')) {\n modelUrl =
(modelUrl as string) + '/';\n }\n modelUrl =
`${modelUrl}${DEFAULT_MODEL_NAME}${TFHUB_SEARCH_PARAM}`;\n }\n }\n\n const model = new
GraphModel(modelUrl, options);\n await model.load();\n return
model;\n } \n\n",null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,"/**\n * dat-gui
JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google
Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\n import Color from './color/Color';\n import math from
'./color/math';\n import interpret from './color/interpret';\n\n import Controller from './controllers/Controller';\n import
BooleanController from './controllers/BooleanController';\n import OptionController from
'./controllers/OptionController';\n import StringController from './controllers/StringController';\n import
NumberController from './controllers/NumberController';\n import NumberControllerBox from
'./controllers/NumberControllerBox';\n import NumberControllerSlider from
'./controllers/NumberControllerSlider';\n import FunctionController from './controllers/FunctionController';\n import
ColorController from './controllers/ColorController';\n\n import domImport from './dom/dom';\n import GUIImport
from './gui/GUI';\n\n export const color = {\n Color: Color,\n math: math,\n interpret: interpret;\n }; \n\n export
const controllers = {\n Controller: Controller,\n BooleanController: BooleanController,\n OptionController:
OptionController,\n StringController: StringController,\n NumberController: NumberController,\n NumberControllerBox:
NumberControllerBox,\n NumberControllerSlider: NumberControllerSlider,\n FunctionController: FunctionController,\n ColorController: ColorController;\n }; \n\n export const dom = { dom:
domImport }; \n\n export const gui = { GUI: GUIImport }; \n\n export const GUI = GUIImport;\n\n export default {\n
 color,\n controllers,\n dom,\n gui,\n GUI;\n }; \n\n",/**\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n

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*\n\nexport default function(color, forceCSSHex) {\n const colorFormat =
color.__state.conversionName.toString();\n\n const r = Math.round(color.r);\n const g = Math.round(color.g);\n const b = Math.round(color.b);\n const a = color.a;\n const h = Math.round(color.h);\n const s =
color.s.toFixed(1);\n const v = color.v.toFixed(1);\n\n if (forceCSSHex || (colorFormat ===
'THREE_CHAR_HEX') || (colorFormat === 'SIX_CHAR_HEX')) {\n let str = color.hex.toString(16);\n while
(str.length < 6) {\n str = '0' + str;\n }\n return '#' + str;\n } else if (colorFormat === 'CSS_RGB') {\n return
'rgb(' + r + ',' + g + ',' + b + ')';\n } else if (colorFormat === 'CSS_RGBA') {\n return 'rgba(' + r + ',' + g + ',' + b +
',' + a + ')';\n } else if (colorFormat === 'HEX') {\n return '0x' + color.hex.toString(16);\n } else if (colorFormat
=== 'RGB_ARRAY') {\n return '[' + r + ',' + g + ',' + b + ']';\n } else if (colorFormat === 'RGBA_ARRAY') {\n return
 '[' + r + ',' + g + ',' + b + ',' + a + ']';\n } else if (colorFormat === 'RGB_OBJ') {\n return '{r:' + r + ',g:' + g +
',b:' + b + ')';\n } else if (colorFormat === 'RGBA_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + ',a:' + a + ')';\n
 } else if (colorFormat === 'HSV_OBJ') {\n return '{h:' + h + ',s:' + s + ',v:' + v + ')';\n } else if (colorFormat ===
'HSVA_OBJ') {\n return '{h:' + h + ',s:' + s + ',v:' + v + ',a:' + a + ')';\n }\n\n return 'unknown
format';\n}\n\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright
2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nconst ARR_EACH =
Array.prototype.forEach;\nconst ARR_SLICE = Array.prototype.slice;\n\n/*\n * Band-aid methods for things that
should be a lot easier in JavaScript.\n * Implementation and structure inspired by underscore.js\n *
http://documentcloud.github.com/underscore/\n */\n\nconst Common = {\n BREAK: {},\n\n extend:
function(target) {\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj)
? Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (!this.isUndefined(obj[key])) {\n
 target[key] = obj[key];\n }\n }.bind(this));\n }, this);\n\n return target;\n },\n\n defaults: function(target)
{\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj) ?
Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (this.isUndefined(target[key])) {\n target[key]
= obj[key];\n }\n }.bind(this));\n }, this);\n\n return target;\n },\n\n compose: function() {\n const
toCall = ARR_SLICE.call(arguments);\n return function() {\n let args = ARR_SLICE.call(arguments);\n for
(let i = toCall.length - 1; i >= 0; i--) {\n args = [toCall[i].apply(this, args)];\n }\n return args[0];\n };
 },\n\n each: function(obj, itr, scope) {\n if (!obj) {\n return;\n }\n\n if (ARR_EACH && obj.forEach &&
obj.forEach === ARR_EACH) {\n obj.forEach(itr, scope);\n } else if (obj.length === obj.length + 0) { // Is
number but not NaN\n let key;\n let l;\n for (key = 0, l = obj.length; key < l; key++) {\n if (key in obj
&& itr.call(scope, obj[key], key) === this.BREAK) {\n return;\n }\n }\n } else {\n for (const key
in obj) {\n if (itr.call(scope, obj[key], key) === this.BREAK) {\n return;\n }\n }\n },\n\n defer: function(fnc) {\n setTimeout(fnc, 0);\n },\n\n // if the function is called repeatedly, wait until threshold
passes until we execute the function\n debounce: function(func, threshold, callImmediately) {\n let timeout;\n\n return function() {\n const obj = this;\n const args = arguments;\n function delayed() {\n timeout =
null;\n if (!callImmediately) func.apply(obj, args);\n }\n\n const callNow = callImmediately ||
!timeout;\n clearTimeout(timeout);\n timeout = setTimeout(delayed, threshold);\n\n if (callNow) {\n func.apply(obj, args);\n }\n },\n\n toArray: function(obj) {\n if (obj.toArray) return obj.toArray();\n return
ARR_SLICE.call(obj);\n },\n\n isUndefined: function(obj) {\n return obj === undefined;\n },\n\n isNull:
function(obj) {\n return obj === null;\n },\n\n isNaN: function(obj) {\n return isNaN(obj);\n },\n\n isArray:
Array.isArray || function(obj) {\n return obj.constructor === Array;\n },\n\n isObject: function(obj) {\n return
obj === Object(obj);\n },\n\n isNumber: function(obj) {\n return obj === obj + 0;\n },\n\n isString:
function(obj) {\n return obj === obj + '';\n },\n\n isBoolean: function(obj) {\n return obj === false || obj ===
true;\n },\n\n isFunction: function(obj) {\n return Object.prototype.toString.call(obj) === '[object Function]';\n
 }\n}\n\nexport default Common;\n\n", "/*\n * dat-gui JavaScript Controller Library\n *\n * Copyright
2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the

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License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nimport toString from './toString';\nimport common from './utils/common';\n\nconst INTERPRETATIONS =
[\n // Strings\n {\n litmus: common.isString,\n conversions: {\n THREE_CHAR_HEX: {\n read:
function(original) {\n const test = original.match(/^[A-F0-9]{3}$/i);\n if (test ===
null) {\n return false;\n }\n return {\n space: 'HEX',\n hex: parseInt(\n '0x'
+\n test[1].toString() + test[1].toString() +\n test[2].toString() + test[2].toString() +\n
test[3].toString() + test[3].toString(), 0)\n };,\n write: toString\n },\n SIX_CHAR_HEX:
{\n read: function(original) {\n const test = original.match(/^[A-F0-9]{6}$/i);\n if (test === null)
{\n return false;\n }\n return {\n space: 'HEX',\n hex: parseInt('0x' +
test[1].toString(), 0)\n };,\n write: toString\n },\n CSS_RGB: {\n read:
function(original) {\n const test = original.match(/^(rgb|(\s*(.)\s*|\s*(.)\s*|\s*(.)\s*\))/);\n if (test
=== null) {\n return false;\n }\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n
g: parseFloat(test[2]),\n b: parseFloat(test[3])\n };,\n write: toString\n },\n CSS_RGBA: {\n
read: function(original) {\n const test =
original.match(/^(rgba|(\s*(.)\s*|\s*(.)\s*|\s*(.)\s*|\s*(.)\s*\))/);\n if (test === null) {\n return
false;\n }\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n g:
parseFloat(test[2]),\n b: parseFloat(test[3]),\n a: parseFloat(test[4])\n };,\n write:
toString\n }\n },\n // Numbers\n {\n litmus: common.isNumber,\n conversions: {\n HEX: {\n
read: function(original) {\n return {\n space: 'HEX',\n hex: original,\n
conversionName: 'HEX'\n };,\n write: function(color) {\n return color.hex;\n }\n
}\n },\n // Arrays\n {\n litmus: common.isArray,\n conversions: {\n RGB_ARRAY: {\n
read: function(original) {\n if (original.length !== 3) {\n return false;\n }\n return {\n
space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2]\n };,\n write:
function(color) {\n return [color.r, color.g, color.b];\n }\n },\n RGBA_ARRAY: {\n read:
function(original) {\n if (original.length !== 4) return false;\n return {\n space: 'RGB',\n r:
original[0],\n g: original[1],\n b: original[2],\n a: original[3]\n };,\n write:
function(color) {\n return [color.r, color.g, color.b, color.a];\n }\n }\n },\n // Objects\n {\n
litmus: common.isObject,\n conversions: {\n RGBA_OBJ: {\n read: function(original) {\n if
(common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n
common.isNumber(original.b) &&\n common.isNumber(original.a)) {\n return {\n space:
'RGB',\n r: original.r,\n g: original.g,\n b: original.b,\n a: original.a\n };,\n
}\n return false;\n },\n write: function(color) {\n return {\n r: color.r,\n g:
color.g,\n b: color.b,\n a: color.a\n };,\n }\n },\n RGB_OBJ: {\n read:
function(original) {\n if (common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n
common.isNumber(original.b)) {\n return {\n space: 'RGB',\n r: original.r,\n g:
original.g,\n b: original.b\n };,\n }\n return false;\n },\n write: function(color)
{\n return {\n r: color.r,\n g: color.g,\n b: color.b\n };,\n }\n },\n
HSVA_OBJ: {\n read: function(original) {\n if (common.isNumber(original.h) &&\n
common.isNumber(original.s) &&\n common.isNumber(original.v) &&\n
common.isNumber(original.a)) {\n return {\n space: 'HSV',\n h: original.h,\n s:
original.s,\n v: original.v,\n a: original.a\n };,\n }\n return false;\n },\n
write: function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v,\n a:
color.a\n };,\n }\n },\n HSV_OBJ: {\n read: function(original) {\n if
(common.isNumber(original.h) &&\n common.isNumber(original.s) &&\n
common.isNumber(original.v)) {\n return {\n space: 'HSV',\n h: original.h,\n s:
original.s,\n v: original.v\n };,\n }\n return false;\n },\n write: function(color) {\n
return {\n h: color.h,\n s: color.s,\n v: color.v\n };,\n }\n }\n }\n]\n\nlet
result;\nlet toReturn;\n\nconst interpret = function() {\n toReturn = false;\n\n const original = arguments.length > 1

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? common.toArray(arguments) : arguments[0];
common.each(INTERPRETATIONS, function(family) {
 (family.litmus(original)) {
 common.each(family.conversions, function(conversion, conversionName) {
 result = conversion.read(original);
 if (toReturn === false && result !== false) {
 toReturn = result;
 result.conversionName = conversionName;
 result.conversion = conversion;
 return
 }
 });
 });
 return common.BREAK;
});
return toReturn;
};
export default interpret;
"/**
 * dat-gui JavaScript Controller Library
 * http://code.google.com/p/dat-gui
 *
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 * "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the
 * License at
 * http://www.apache.org/licenses/LICENSE-2.0
 */
let tmpComponent;
const ColorMath = {
 hsv_to_rgb: function(h, s, v) {
 const hi = Math.floor(h / 60) % 6;
 const f = h / 60 - Math.floor(h / 60);
 const p = v * (1.0 - s);
 const q = v * (1.0 - (f * s));
 const t = v * (1.0 - ((1.0 - f) * s));
 const c = [
 [v, t, p],
 [q, v, p],
 [p, v, t],
 [p, q, v],
 [t, p, v],
 [v, p, q]
][hi];
 return {
 r: c[0] * 255,
 g: c[1] * 255,
 b: c[2] * 255
 };
 },
 rgb_to_hsv: function(r, g, b) {
 const min = Math.min(r, g, b);
 const max = Math.max(r, g, b);
 const delta = max - min;
 let h;
 let s;
 if (max !== 0) {
 s = delta / max;
 } else {
 return {
 h: NaN,
 s: 0,
 v: 0
 };
 }
 if (r === max) {
 h = (g - b) / delta;
 } else if (g === max) {
 h = 2 + (b - r) / delta;
 } else {
 h = 4 + (r - g) / delta;
 }
 h /= 6;
 if (h < 0) {
 h += 1;
 }
 return {
 h: h * 360,
 s: s,
 v: max / 255
 };
 },
 rgb_to_hex: function(r, g, b) {
 let hex = this.hex_with_component(0, 2, r);
 hex = this.hex_with_component(hex, 1, g);
 hex = this.hex_with_component(hex, 0, b);
 return hex;
 },
 component_from_hex: function(hex, componentIndex) {
 return (hex >> (componentIndex * 8)) & 0xFF;
 },
 hex_with_component: function(hex, componentIndex, value) {
 return value << (tmpComponent = componentIndex * 8) | (hex & ~(0xFF << tmpComponent));
 }
};
export default ColorMath;
"/**
 * dat-gui JavaScript Controller Library
 * http://code.google.com/p/dat-gui
 *
 * Copyright 2011 Data Arts Team,
 * Google Creative Lab
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use
 * this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 */
import interpret from './interpret';
import math from './math';
import colorToString from './toString';
import common from './utils/common';
class Color {
 constructor() {
 this.__state = interpret.apply(this, arguments);
 if (this.__state === false) {
 throw new Error('Failed to interpret color arguments');
 }
 this.__state.a = this.__state.a || 1;
 }
 toString() {
 return colorToString(this);
 }
 toHexString() {
 return colorToString(this, true);
 }
 toOriginal() {
 return this.__state.conversion.write(this);
 }
 function defineRGBComponent(target, component, componentHexIndex) {
 Object.defineProperty(target, component, {
 get: function() {
 if (this.__state.space === 'RGB') {
 return this.__state[component];
 }
 Color.recalculateRGB(this, component, componentHexIndex);
 return this.__state[component];
 },
 set: function(v) {
 if (this.__state.space !== 'RGB') {
 Color.recalculateRGB(this, component, componentHexIndex);
 }
 this.__state.space = 'RGB';
 this.__state[component] = v;
 }
 });
 }
 function defineHSVComponent(target, component) {
 Object.defineProperty(target, component, {
 get: function() {
 if (this.__state.space === 'HSV') {
 return this.__state[component];
 }
 Color.recalculateHSV(this);
 return this.__state[component];
 },
 set: function(v) {
 if (this.__state.space !== 'HSV') {
 Color.recalculateHSV(this);
 this.__state.space = 'HSV';
 }
 this.__state[component] = v;
 }
 });
 }
 Color.recalculateRGB = function(color, component, componentHexIndex) {
 if (color.__state.space === 'HEX') {
 color.__state[component] = math.component_from_hex(color.__state.hex, componentHexIndex);
 } else if (color.__state.space === 'HSV') {
 common.extend(color.__state, math.hsv_to_rgb(color.__state.h, color.__state.s, color.__state.v));
 } else {
 throw new Error('Corrupted color state');
 }
 }
 Color.recalculateHSV = function(color) {
 const result = math.rgb_to_hsv(color.r, color.g, color.b);
 common.extend(color.__state, {
 s: result.s,
 v: result.v
 });
 if (!common.isNaN(result.h)) {
 color.__state.h = result.h;
 } else if (common.isUndefined(color.__state.h)) {
 color.__state.h = 0;
 }
 }
 Color.COMPONENTS = ['r', 'g', 'b', 'h',

```



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= selectable ? function() {\n return false;\n } : function() {\n };\n\n elem.style.MozUserSelect = selectable ?
'auto' : 'none';\n elem.style.KhtmlUserSelect = selectable ? 'auto' : 'none';\n elem.unselectable = selectable ? 'on' :
'off';\n },\n\n /**\n *\n * @param elem\n * @param horizontal\n * @param vert\n */\n makeFullscreen:
function(elem, hor, vert) {\n let vertical = vert;\n let horizontal = hor;\n\n if (common.isUndefined(horizontal))
{\n horizontal = true;\n }\n\n if (common.isUndefined(vertical)) {\n vertical = true;\n }\n\n elem.style.position = 'absolute';\n\n if (horizontal) {\n elem.style.left = 0;\n elem.style.right = 0;\n }\n if
(vertical) {\n elem.style.top = 0;\n elem.style.bottom = 0;\n }\n},\n\n /**\n *\n * @param elem\n *
@param eventType\n * @param params\n */\n fakeEvent: function(elem, eventType, pars, aux) {\n const
params = pars || {};\n const className = EVENT_MAP_INV[eventType];\n if (!className) {\n throw new
Error('Event type ' + eventType + ' not supported.);\n }\n const evt = document.createEvent(className);\n
switch (className) {\n case 'MouseEvents':\n {\n const clientX = params.x || params.clientX || 0;\n
 const clientY = params.y || params.clientY || 0;\n evt.initMouseEvent(eventType, params.bubbles || false,\n params.cancelable || true, window, params.clickCount || 1,\n 0, // screen X\n 0, // screen Y\n clientX, // client X\n clientY, // client Y\n false, false, false, false, 0, null);\n break;\n }\n case 'KeyboardEvents':\n {\n const init = evt.initKeyboardEvent || evt.initKeyEvent; // webkit || moz\n
 common.defaults(params, {\n cancelable: true,\n ctrlKey: false,\n altKey: false,\n
 shiftKey: false,\n metaKey: false,\n keyCode: undefined,\n charCode: undefined\n });\n init(eventType, params.bubbles || false,\n params.cancelable, window,\n params.ctrlKey,\n
 params.altKey,\n params.shiftKey, params.metaKey,\n params.keyCode, params.charCode);\n break;\n }\n default:\n {\n evt.initEvent(eventType, params.bubbles || false, params.cancelable ||
 true);\n break;\n }\n }\n common.defaults(evt, aux);\n elem.dispatchEvent(evt);\n },\n\n /**\n *\n * @param elem\n * @param event\n * @param func\n * @param bool\n */\n bind: function(elem, event, func,
newBool) {\n const bool = newBool || false;\n if (elem.addEventListener) {\n elem.addEventListener(event,
func, bool);\n } else if (elem.attachEvent) {\n elem.attachEvent('on' + event, func);\n }\n return dom;\n
},\n\n /**\n *\n * @param elem\n * @param event\n * @param func\n * @param bool\n */\n unbind:
function(elem, event, func, newBool) {\n const bool = newBool || false;\n if (elem.removeEventListener) {\n
elem.removeEventListener(event, func, bool);\n } else if (elem.detachEvent) {\n elem.detachEvent('on' + event,
func);\n }\n return dom;\n },\n\n /**\n *\n * @param elem\n * @param className\n */\n addClass:
function(elem, className) {\n if (elem.className === undefined) {\n elem.className = className;\n } else
if (elem.className !== className) {\n const classes = elem.className.split(/ +/);\n if
(classes.indexOf(className) === -1) {\n classes.push(className);\n elem.className = classes.join('
').replace(/^\s+/, "").replace(/\s+$/, "");\n }\n }\n return dom;\n },\n\n /**\n *\n * @param elem\n *
@param className\n */\n removeClass: function(elem, className) {\n if (className) {\n if
(elem.className === className) {\n elem.removeAttribute('class');\n } else {\n const classes =
elem.className.split(/ +/);\n const index = classes.indexOf(className);\n if (index !== -1) {\n
classes.splice(index, 1);\n elem.className = classes.join(' ');\n }\n }\n } else {\n elem.className
= undefined;\n }\n return dom;\n },\n\n hasClass: function(elem, className) {\n return new
RegExp('(?:^|\\s+)' + className + '(?:\\s+|$)').test(elem.className) || false;\n },\n\n /**\n *\n * @param
elem\n */\n getWidth: function(elem) {\n const style = getComputedStyle(elem);\n\n return
cssValueToPixels(style['border-left-width']) +\n cssValueToPixels(style['border-right-width']) +\n
cssValueToPixels(style['padding-left']) +\n cssValueToPixels(style['padding-right']) +\n
cssValueToPixels(style.width);\n },\n\n /**\n *\n * @param elem\n */\n getHeight: function(elem) {\n const
style = getComputedStyle(elem);\n\n return cssValueToPixels(style['border-top-width']) +\n
cssValueToPixels(style['border-bottom-width']) +\n cssValueToPixels(style['padding-top']) +\n
cssValueToPixels(style['padding-bottom']) +\n cssValueToPixels(style.height);\n },\n\n /**\n *\n * @param
el\n */\n getOffset: function(el) {\n let elem = el;\n const offset = { left: 0, top: 0 };\n if (elem.offsetParent)
{\n do {\n offset.left += elem.offsetLeft;\n offset.top += elem.offsetTop;\n elem =
elem.offsetParent;\n } while (elem);\n }\n return offset;\n },\n\n //

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http://stackoverflow.com/posts/2684561/visions\n /*\n *\n * @param elem\n *\n isActive: function(elem)
{\n return elem === document.activeElement && (elem.type || elem.href);\n }\n};\n\nexport default
dom;\n", /*\n *\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011
Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from './Controller';\nimport dom from
'./dom/dom';\n\n/*\n *\n * @class Provides a checkbox input to alter the boolean property of an object.\n *\n *
@extends dat.controllers.Controller\n *\n * @param {Object} object The object to be manipulated\n *\n * @param
{string} property The name of the property to be manipulated\n *\n\nclass BooleanController extends Controller {\n
constructor(object, property) {\n super(object, property);\n\n const _this = this;\n this.__prev =
this.getValue();\n\n this.__checkbox = document.createElement('input');\n this.__checkbox.setAttribute('type',
'checkbox');\n\n function onChange() {\n _this.setValue(!_this.__prev);\n }\n\n dom.bind(this.__checkbox,
'change', onChange, false);\n\n this.domElement.appendChild(this.__checkbox);\n\n // Match original value\n
this.updateDisplay();\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n if (this.__onFinishChange)
{\n this.__onFinishChange.call(this, this.getValue());\n }\n this.__prev = this.getValue();\n return
toReturn;\n }\n\n updateDisplay() {\n if (this.getValue() === true) {\n this.__checkbox.setAttribute('checked',
'checked');\n this.__checkbox.checked = true;\n this.__prev = true;\n } else {\n this.__checkbox.checked
= false;\n this.__prev = false;\n }\n\n return super.updateDisplay();\n }\n}\n\nexport default
BooleanController;\n", /*\n *\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n *
Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from
'./Controller';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\n/*\n *\n * @class Provides
a select input to alter the property of an object, using a\n *\n * list of accepted values.\n *\n * @extends
dat.controllers.Controller\n *\n * @param {Object} object The object to be manipulated\n *\n * @param {string}
property The name of the property to be manipulated\n *\n * @param {Object|string[]} options A map of labels to
acceptable values, or\n *\n * a list of acceptable string values.\n *\n\nclass OptionController extends Controller {\n
constructor(object, property, opts) {\n super(object, property);\n\n let options = opts;\n\n const _this = this;\n\n
/*\n *\n * The drop down menu\n *\n * @ignore\n *\n this.__select = document.createElement('select');\n\n if
(common.isArray(options)) {\n const map = {};\n common.each(options, function(element) {\n
map[element] = element;\n });\n options = map;\n }\n\n common.each(options, function(value, key) {\n
const opt = document.createElement('option');\n opt.innerHTML = key;\n opt.setAttribute('value', value);\n
_this.__select.appendChild(opt);\n });\n\n // Acknowledge original value\n this.updateDisplay();\n\n
dom.bind(this.__select, 'change', function() {\n const desiredValue = this.options[this.selectedIndex].value;\n
_this.setValue(desiredValue);\n });\n\n this.domElement.appendChild(this.__select);\n }\n\n setValue(v) {\n
const toReturn = super.setValue(v);\n\n if (this.__onFinishChange) {\n this.__onFinishChange.call(this,
this.getValue());\n }\n return toReturn;\n }\n\n updateDisplay() {\n if (dom.isActive(this.__select)) return
this; // prevent number from updating if user is trying to manually update\n this.__select.value = this.getValue();\n
return super.updateDisplay();\n }\n}\n\nexport default OptionController;\n", /*\n *\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from './Controller';\nimport dom from
'./dom/dom';\n\n/*\n *\n * @class Provides a text input to alter the string property of an object.\n *\n *
@extends dat.controllers.Controller\n *\n * @param {Object} object The object to be manipulated\n *\n * @param {string}
property The name of the property to be manipulated\n *\n\nclass StringController extends Controller {\n
constructor(object, property) {\n super(object, property);\n\n const _this = this;\n\n function onChange() {\n
_this.setValue(_this.__input.value);\n }\n\n function onBlur() {\n if (_this.__onFinishChange) {\n

```





```

* @param {Number} [params.min] Minimum allowed value\n * @param {Number} [params.max] Maximum
allowed value\n * @param {Number} [params.step] Increment by which to change value\n */\n\nclass
NumberControllerBox extends NumberController {\n constructor(object, property, params) {\n super(object,
property, params);\n\n this.__truncationSuspended = false;\n\n const _this = this;\n\n /**\n * {Number}
Previous mouse y position\n * @ignore\n */\n let prevY;\n\n function onChange() {\n const attempted =
parseFloat(_this.__input.value);\n if (!common.isNaN(attempted)) {\n _this.setValue(attempted);\n }\n\n }\n\n function onFinish() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this,
_this.getValue());\n }\n }\n\n function onBlur() {\n onFinish();\n }\n\n function onMouseDrag(e) {\n const diff = prevY - e.clientY;\n _this.setValue(_this.getValue() + diff * _this.__impliedStep);\n\n prevY =
e.clientY;\n }\n\n function onMouseUp() {\n dom.unbind(window, 'mousemove', onMouseDrag);\n dom.unbind(window, 'mouseup', onMouseUp);\n onFinish();\n }\n\n function onMouseDown(e) {\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window, 'mouseup', onMouseUp);\n prevY =
e.clientY;\n }\n\n this.__input = document.createElement('input');\n this.__input.setAttribute('type', 'text');\n\n // Makes it so manually specified values are not truncated.\n dom.bind(this.__input, 'change', onChange);\n dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'mousedown', onMouseDown);\n dom.bind(this.__input, 'keydown', function(e) {\n // When pressing enter, you can be as precise as you want.\n if (e.keyCode === 13) {\n _this.__truncationSuspended = true;\n this.blur();\n\n _this.__truncationSuspended = false;\n onFinish();\n }\n });\n\n this.updateDisplay();\n\n this.domElement.appendChild(this.__input);\n }\n\n updateDisplay() {\n this.__input.value =
this.__truncationSuspended ? this.getValue() : roundToDecimal(this.getValue(), this.__precision);\n return
super.updateDisplay();\n }\n}\n\nexport default NumberControllerBox;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport NumberController from './NumberController';\nimport
dom from './dom/dom';\n\nfunction map(v, i1, i2, o1, o2) {\n return o1 + (o2 - o1) * ((v - i1) / (i2 - i1));\n}\n\n/**\n
 * @class Represents a given property of an object that is a number, contains\n * a minimum and maximum, and
provides a slider element with which to\n * manipulate it. It should be noted that the slider element is made up of\n
 * <code><div></code> tags, not the html5\n * <code><slider></code> element.\n * \n *
@extends dat.controllers.Controller\n * @extends dat.controllers.NumberController\n * \n * @param {Object}
object The object to be manipulated\n * @param {string} property The name of the property to be manipulated\n *
@param {Number} minValue Minimum allowed value\n * @param {Number} maxValue Maximum allowed
value\n * @param {Number} stepValue Increment by which to change value\n */\n\nclass NumberControllerSlider
extends NumberController {\n constructor(object, property, min, max, step) {\n super(object, property, { min:
min, max: max, step: step });\n\n const _this = this;\n\n this.__background = document.createElement('div');\n this.__foreground = document.createElement('div');\n\n dom.bind(this.__background, 'mousedown',
onMouseDown);\n dom.bind(this.__background, 'touchstart', onTouchStart);\n\n dom.addClass(this.__background, 'slider');\n dom.addClass(this.__foreground, 'slider-fg');\n\n function
onMouseDown(e) {\n document.activeElement.blur();\n\n dom.bind(window, 'mousemove', onMouseDrag);\n\n dom.bind(window, 'mouseup', onMouseUp);\n\n onMouseDrag(e);\n }\n\n function onMouseDrag(e) {\n e.preventDefault();\n\n const bgRect = _this.__background.getBoundingClientRect();\n\n _this.setValue(\n map(e.clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n\n return false;\n }\n\n function
onMouseUp() {\n dom.unbind(window, 'mousemove', onMouseDrag);\n dom.unbind(window, 'mouseup',
onMouseUp);\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n function onTouchStart(e) {\n if (e.touches.length !== 1) { return; }\n dom.bind(window,
'touchmove', onTouchMove);\n dom.bind(window, 'touchend', onTouchEnd);\n onTouchMove(e);\n }\n\n function onTouchMove(e) {\n const clientX = e.touches[0].clientX;\n const bgRect =
_this.__background.getBoundingClientRect();\n\n _this.setValue(\n map(clientX, bgRect.left, bgRect.right,

```



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});\n\n common.extend(this.__saturation_field.style, {\n width: '100px',\n height: '100px',\n border: '1px\n solid #555',\n marginRight: '3px',\n display: 'inline-block',\n cursor: 'pointer'\n });\n\n common.extend(valueField.style, {\n width: '100%',\n height: '100%',\n background: 'none'\n });\n\n linearGradient(valueField, 'top', 'rgba(0,0,0,0)', '#000');\n\n common.extend(this.__hue_field.style, {\n width:\n '15px',\n height: '100px',\n border: '1px solid #555',\n cursor: 'ns-resize',\n position: 'absolute',\n top:\n '3px',\n right: '3px'\n });\n\n hueGradient(this.__hue_field);\n\n common.extend(this.__input.style, {\n outline: 'none',\n // width: '120px',\n textAlign: 'center',\n // padding: '4px',\n // marginBottom: '6px',\n color: '#fff',\n border: 0,\n fontWeight: 'bold',\n textShadow: this.__input_textShadow + 'rgba(0,0,0,0.7)'\n });\n\n dom.bind(this.__saturation_field, 'mousedown', fieldDown);\n dom.bind(this.__saturation_field,\n 'touchstart', fieldDown);\n\n dom.bind(this.__field_knob, 'mousedown', fieldDown);\n\n dom.bind(this.__field_knob, 'touchstart', fieldDown);\n\n dom.bind(this.__hue_field, 'mousedown',\n fieldDownH);\n dom.bind(this.__hue_field, 'touchstart', fieldDownH);\n\n function fieldDown(e) {\n setSV(e);\n dom.bind(window, 'mousemove', setSV);\n dom.bind(window, 'touchmove', setSV);\n dom.bind(window, 'mouseup', fieldUpSV);\n dom.bind(window, 'touchend', fieldUpSV);\n }\n\n function\n fieldDownH(e) {\n setH(e);\n dom.bind(window, 'mousemove', setH);\n dom.bind(window, 'touchmove',\n setH);\n dom.bind(window, 'mouseup', fieldUpH);\n dom.bind(window, 'touchend', fieldUpH);\n }\n\n function fieldUpSV() {\n dom.unbind(window, 'mousemove', setSV);\n dom.unbind(window, 'touchmove',\n setSV);\n dom.unbind(window, 'mouseup', fieldUpSV);\n dom.unbind(window, 'touchend', fieldUpSV);\n\n onFinish();\n }\n\n function fieldUpH() {\n dom.unbind(window, 'mousemove', setH);\n dom.unbind(window, 'touchmove', setH);\n dom.unbind(window, 'mouseup', fieldUpH);\n dom.unbind(window, 'touchend', fieldUpH);\n\n onFinish();\n }\n\n function onBlur() {\n const i =\n interpret(this.value);\n if (i !== false) {\n __this.__color.__state = i;\n __this.setValue(__this.__color.toOriginal());\n } else {\n this.value = __this.__color.toString();\n }\n }\n\n function onFinish() {\n if (__this.__onFinishChange) {\n __this.__onFinishChange.call(__this,\n __this.__color.toOriginal());\n }\n }\n\n this.__saturation_field.appendChild(valueField);\n\n this.__selector.appendChild(this.__field_knob);\n this.__selector.appendChild(this.__saturation_field);\n\n this.__selector.appendChild(this.__hue_field);\n this.__hue_field.appendChild(this.__hue_knob);\n\n this.domElement.appendChild(this.__input);\n this.domElement.appendChild(this.__selector);\n\n this.updateDisplay();\n\n function setSV(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n\n const fieldRect = __this.__saturation_field.getBoundingClientRect();\n const { clientX, clientY } = (e.touches &&\n e.touches[0]) || e;\n let s = (clientX - fieldRect.left) / (fieldRect.right - fieldRect.left);\n let v = 1 - (clientY -\n fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n\n if (v > 1) {\n v = 1;\n } else if (v < 0) {\n v =\n 0;\n }\n\n if (s > 1) {\n s = 1;\n } else if (s < 0) {\n s = 0;\n }\n\n __this.__color.v = v;\n __this.__color.s = s;\n __this.setValue(__this.__color.toOriginal());\n\n return false;\n }\n\n function\n setH(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n\n const fieldRect =\n __this.__hue_field.getBoundingClientRect();\n const { clientY } = (e.touches && e.touches[0]) || e;\n let h = 1\n - (clientY - fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n\n if (h > 1) {\n h = 1;\n } else if (h < 0)\n {\n h = 0;\n }\n\n __this.__color.h = h * 360;\n __this.setValue(__this.__color.toOriginal());\n\n return false;\n }\n\n }\n\n updateDisplay() {\n const i = interpret(this.getValue());\n\n if (i !== false) {\n let\n mismatch = false;\n\n // Check for mismatch on the interpreted value.\n\n\n common.each(Color.COMPONENTS, function(component) {\n if (!common.isUndefined(i[component]) &&\n !common.isUndefined(this.__color.__state[component]) &&\n i[component] !==\n this.__color.__state[component]) {\n mismatch = true;\n return {}; // break\n }\n }, this);\n\n //\n If nothing diverges, we keep our previous values\n // for statefulness, otherwise we recalculate fresh\n if\n (mismatch) {\n common.extend(this.__color.__state, i);\n }\n\n\n common.extend(this.__temp.__state,\n this.__color.__state);\n\n this.__temp.a = 1;\n\n const flip = (this.__color.v < 0.5 || this.__color.s > 0.5) ? 255 :\n 0;\n const _flip = 255 - flip;\n\n common.extend(this.__field_knob.style, {\n marginLeft: 100 * this.__color.s\n - 7 + 'px',\n marginTop: 100 * (1 - this.__color.v) - 7 + 'px',\n backgroundColor: this.__temp.toHexString(),\n
```

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border: this.__field_knob_border + 'rgb(' + flip + ',' + flip + ',' + flip + ')\n });\n\n
this.__hue_knob.style.marginTop = (1 - this.__color.h / 360) * 100 + 'px';\n\n this.__temp.s = 1;\n this.__temp.v
= 1;\n\n linearGradient(this.__saturation_field, 'left', '#fff', this.__temp.toHexString());\n\n this.__input.value =
this.__color.toString();\n\n common.extend(this.__input.style, {\n backgroundColor:
this.__color.toHexString(),\n color: 'rgb(' + flip + ',' + flip + ',' + flip + ');\n textShadow:
this.__input_textShadow + 'rgba(' + _flip + ',' + _flip + ',' + _flip + ',.7)\n });\n };\n\n\nconst vendors = ['-moz-', '-
o-', '-webkit-', '-ms-', ''];\n\nfunction linearGradient(elem, x, a, b) {\n elem.style.background = ";\n
common.each(vendors, function(vendor) {\n elem.style.cssText += 'background: ' + vendor + 'linear-gradient(' + x
+ ', ' + a + ' 0%, ' + b + ' 100%);';\n });\n}\n\nfunction hueGradient(elem) {\n elem.style.background = ";\n
elem.style.cssText += 'background: -moz-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%,
#00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -webkit-linear-gradient(top,
#ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n
elem.style.cssText += 'background: -o-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff
50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -ms-linear-gradient(top,
#ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n
elem.style.cssText += 'background: linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00
67%, #ffff00 84%, #ff0000 100%);';\n }\n\n\nexport default ColorController;\n\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nconst css = {\n load: function(url, indoc) {\n const doc =
indoc || document;\n const link = doc.createElement('link');\n link.type = 'text/css';\n link.rel = 'stylesheet';\n
link.href = url;\n doc.getElementsByTagName('head')[0].appendChild(link);\n },\n\n inject: function(cssContent,
indoc) {\n const doc = indoc || document;\n const injected = document.createElement('style');\n injected.type =
'text/css';\n injected.innerHTML = cssContent;\n const head = doc.getElementsByTagName('head')[0];\n try
{\n head.appendChild(injected);\n } catch (e) { // Unable to inject CSS, probably because of a Content Security
Policy\n }\n }\n\n\nexport default css;\n\n", "const saveDialogContent = `<div id=\"dg-save\" class=\"dg
dialogue\">\n\n Here's the new load parameter for your <code>GUI</code>'s constructor:\n\n <textarea id=\"dg-
new-constructor\"></textarea>\n\n <div id=\"dg-save-locally\">\n\n <input id=\"dg-local-storage\"
type=\"checkbox\"/> Automatically save\n values to <code>localStorage</code> on exit.\n\n <div id=\"dg-local-
explain\">The values saved to <code>localStorage</code> will\n override those passed to
<code>dat.GUI</code>'s constructor. This makes it\n easier to work incrementally, but
<code>localStorage</code> is fragile,\n and your friends may not see the same values you do.\n\n </div>\n\n
</div>\n\n</div>`;\n\n\nexport default saveDialogContent;\n\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nimport OptionController from './OptionController';\nimport NumberControllerBox from
 './NumberControllerBox';\nimport NumberControllerSlider from './NumberControllerSlider';\nimport
StringController from './StringController';\nimport FunctionController from './FunctionController';\nimport
BooleanController from './BooleanController';\nimport common from './utils/common';\n\nconst ControllerFactory
= function(object, property) {\n const initialValue = object[property];\n\n // Providing options?\n if
(common.isArray(arguments[2]) || common.isObject(arguments[2])) {\n return new OptionController(object,
property, arguments[2]);\n }\n\n // Providing a map?\n if (common.isNumber(initialValue)) {\n // Has min and
max? (slider)\n if (common.isNumber(arguments[2]) && common.isNumber(arguments[3])) {\n // has step?\n
if (common.isNumber(arguments[4])) {\n return new NumberControllerSlider(object, property,\n
arguments[2], arguments[3], arguments[4]);\n }\n\n return new NumberControllerSlider(object, property,
arguments[2], arguments[3]);\n }\n\n // number box\n if (common.isNumber(arguments[4])) { // has step\n

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return new NumberControllerBox(object, property, { min: arguments[2], max: arguments[3], step:
arguments[4] });\n } \n return new NumberControllerBox(object, property, { min: arguments[2], max:
arguments[3] });\n } \n\n if (common.isString(initialValue)) {\n return new StringController(object, property);\n
}\n\n if (common.isFunction(initialValue)) {\n return new FunctionController(object, property, "");\n } \n\n if
(common.isBoolean(initialValue)) {\n return new BooleanController(object, property);\n } \n\n return
null;\n};\n\nexport default ControllerFactory;\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*/\n\nfunction requestAnimationFrame(callback) {\n setTimeout(callback, 1000 / 60);\n}\n\nexport default
window.requestAnimationFrame ||\n window.webkitRequestAnimationFrame ||\n
window.mozRequestAnimationFrame ||\n window.oRequestAnimationFrame ||\n
window.msRequestAnimationFrame ||\n requestAnimationFrame;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport dom from './dom/dom';\nimport common from
'./utils/common';\n\nclass CenteredDiv {\n constructor() {\n this.backgroundElement =
document.createElement('div');\n common.extend(this.backgroundElement.style, {\n backgroundColor:
'rgba(0,0,0,0.8)',\n top: 0,\n left: 0,\n display: 'none',\n zIndex: '1000',\n opacity: 0,\n
WebkitTransition: 'opacity 0.2s linear',\n transition: 'opacity 0.2s linear'\n });\n\n
dom.makeFullscreen(this.backgroundElement);\n this.backgroundElement.style.position = 'fixed';\n\n
this.domElement = document.createElement('div');\n common.extend(this.domElement.style, {\n position:
'fixed',\n display: 'none',\n zIndex: '1001',\n opacity: 0,\n WebkitTransition: '-webkit-transform 0.2s
ease-out, opacity 0.2s linear',\n transition: 'transform 0.2s ease-out, opacity 0.2s linear'\n });\n\n\n
document.body.appendChild(this.backgroundElement);\n document.body.appendChild(this.domElement);\n\n
const _this = this;\n dom.bind(this.backgroundElement, 'click', function() {\n _this.hide();\n });\n }\n\n
show() {\n const _this = this;\n\n this.backgroundElement.style.display = 'block';\n\n
this.domElement.style.display = 'block';\n this.domElement.style.opacity = 0;\n// this.domElement.style.top =
'52%';\n this.domElement.style.webkitTransform = 'scale(1.1)';\n\n this.layout();\n\n common.defer(function()
{\n _this.backgroundElement.style.opacity = 1;\n _this.domElement.style.opacity = 1;\n
_this.domElement.style.webkitTransform = 'scale(1)';\n });\n }\n\n /*\n * Hide centered div\n */\n hide() {\n
const _this = this;\n\n const hide = function() {\n _this.domElement.style.display = 'none';\n
_this.backgroundElement.style.display = 'none';\n\n dom.unbind(_this.domElement, 'webkitTransitionEnd',
hide);\n dom.unbind(_this.domElement, 'transitionend', hide);\n dom.unbind(_this.domElement,
'oTransitionEnd', hide);\n });\n\n dom.bind(this.domElement, 'webkitTransitionEnd', hide);\n
dom.bind(this.domElement, 'transitionend', hide);\n dom.bind(this.domElement, 'oTransitionEnd', hide);\n\n
this.backgroundElement.style.opacity = 0;\n// this.domElement.style.top = '48%';\n
this.domElement.style.opacity = 0;\n this.domElement.style.webkitTransform = 'scale(1.1)';\n }\n\n layout() {\n
this.domElement.style.left = window.innerWidth / 2 - dom.getWidth(this.domElement) / 2 + 'px';\n
this.domElement.style.top = window.innerHeight / 2 - dom.getHeight(this.domElement) / 2 + 'px';\n }\n}\n\nexport
default CenteredDiv;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *
Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport css from './utils/css';\nimport
saveDialogueContents from './saveDialogue.html';\nimport ControllerFactory from
'./controllers/ControllerFactory';\nimport Controller from './controllers/Controller';\nimport BooleanController
from './controllers/BooleanController';\nimport FunctionController from './controllers/FunctionController';\nimport

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NumberControllerBox from './controllers/NumberControllerBox';\nimport NumberControllerSlider from
'./controllers/NumberControllerSlider';\nimport ColorController from './controllers/ColorController';\nimport
requestAnimationFrame from './utils/requestAnimationFrame';\nimport CenteredDiv from
'./dom/CenteredDiv';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\nimport
styleSheet from './style.scss'; // CSS to embed in build\nncss.inject(styleSheet);\n\n/** @ignore Outer-most
className for GUI's *\nconst CSS_NAMESPACE = 'dg';\nconst HIDE_KEY_CODE = 72;\n\n/** @ignore The
only value shared between the JS and SCSS. Use caution. *\nconst CLOSE_BUTTON_HEIGHT = 20;\nconst
DEFAULT_DEFAULT_PRESET_NAME = 'Default';\nconst SUPPORTS_LOCAL_STORAGE = (function() {\n
try {\n return !!window.localStorage;\n } catch (e) {\n return false;\n }\n})();\n\nlet
SAVE_DIALOGUE;\n\n/** @ignore Have we yet to create an autoPlace GUI? *\nlet autoPlaceVirgin =
true;\n\n/** @ignore Fixed position div that auto place GUI's go inside *\nlet autoPlaceContainer;\n\n/** @ignore
Are we hiding the GUI's ? *\nlet hide = false;\n\n/** @private GUI's which should be hidden *\nconst
hideableGuis = [];\n\n/**\n * @class A lightweight controller library for JavaScript. It allows you to easily\n *
manipulate variables and fire functions on the fly.\n * \n * @typicalname gui\n * \n * @example\n * // Creating a
GUI with options.\n * var gui = new dat.GUI({name: 'My GUI'});\n * \n * @example\n * // Creating a GUI and a
subfolder.\n * var gui = new dat.GUI();\n * var folder1 = gui.addFolder('Flow Field');\n * \n * @param {Object}
[params]\n * @param {String} [params.name] The name of this GUI.\n * @param {Object} [params.load] JSON
object representing the saved state of\n * this GUI.\n * @param {dat.gui.GUI} [params.parent] The GUI I'm nested
in.\n * @param {Boolean} [params.autoPlace=true]\n * @param {Boolean} [params.hideable=true] If true, GUI is
shown/hidden by <kbd>h</kbd> keypress.\n * @param {Boolean} [params.closed=false] If true, starts closed\n *
@param {Boolean} [params.closeOnTop=false] If true, close/open button shows on top of the GUI\n *\nconst GUI
= function(pars) {\n const _this = this;\n let params = pars || {};\n /**\n * Outermost DOM Element\n *
@type {DOMELEMENT}\n * \n * this.domElement = document.createElement('div');\n * this.__ul =
document.createElement('ul');\n * this.domElement.appendChild(this.__ul);\n * dom.addClass(this.domElement,
CSS_NAMESPACE);\n * \n * Nested GUI's by name\n * @ignore\n * \n * this.__folders = {};\n *
this.__controllers = [];\n * \n * List of objects I'm remembering for save, only used in top level GUI\n *
@ignore\n * \n * this.__rememberedObjects = [];\n * \n * Maps the index of remembered objects to a map of
controllers, only used\n * in top level GUI.\n * \n * @private\n * @ignore\n * \n * @example\n * [\n *
{ \n * propertyName: Controller,\n * anotherPropertyName: Controller\n * },\n * {\n * propertyName:
Controller\n * }\n *]\n * \n * \n * this.__rememberedObjectIndecesToControllers = [];\n * \n * this.__listening = [];\n *
\n * // Default parameters\n * params = common.defaults(params, {\n * closeOnTop: false,\n * autoPlace: true,\n * width:
GUI.DEFAULT_WIDTH\n * });\n * \n * params = common.defaults(params, {\n * resizable: params.autoPlace,\n *
hideable: params.autoPlace\n * });\n * \n * if (!common.isUndefined(params.load)) {\n * // Explicit preset\n * if
(params.preset) {\n * params.load.preset = params.preset;\n * }\n * } else {\n * params.load = { preset:
DEFAULT_DEFAULT_PRESET_NAME };\n * }\n * \n * if (common.isUndefined(params.parent) &&
params.hideable) {\n * hideableGuis.push(this);\n * }\n * \n * // Only root level GUI's are resizable.\n * params.resizable =
common.isUndefined(params.parent) && params.resizable;\n * \n * if (params.autoPlace &&
common.isUndefined(params.scrollable)) {\n * params.scrollable = true;\n * }\n * \n * // params.scrollable =
common.isUndefined(params.parent) && params.scrollable === true;\n * \n * // Not part of params because I don't
want people passing this in via\n * // constructor. Should be a 'remembered' value.\n * let useLocalStorage =\n * SUPPORTS_LOCAL_STORAGE &&\n * localStorage.getItem(getLocalStorageHash(this, 'isLocal')) ===
'true';\n * \n * let saveToLocalStorage;\n * \n * Object.defineProperties(this, {\n * /** @lends GUI.prototype
*\n * {\n * /**\n * * The parent <code>GUI</code>\n * * @type dat.gui.GUI\n * * \n * parent: {\n
 * get: function() {\n * return params.parent;\n * }\n * },\n * scrollable: {\n * get: function() {\n
 * return params.scrollable;\n * }\n * },\n * /**\n * * Handles <code>GUI</code>'s element placement for
you\n * * @type Boolean\n * * \n * autoPlace: {\n * get: function() {\n * return params.autoPlace;\n
 * }\n * },\n * /**\n * * Handles <code>GUI</code>'s position of open/close button\n * * @type Boolean\n
 * * \n * closeOnTop: {\n * get: function() {\n * return params.closeOnTop;\n * }\n * },\n * /**\n *

```

```

The identifier for a set of saved values\n
 * @type String\n
 */\n
 preset: {\n
 get: function() {\n
 if\n
 (_this.parent) {\n
 return _this.getRoot().preset;\n
 }\n
 return params.load.preset;\n
 },\n
 set: function(v) {\n
 if (_this.parent) {\n
 _this.getRoot().preset = v;\n
 } else {\n
 params.load.preset = v;\n
 }\n
 setPresetSelectIndex(this);\n
 _this.revert();\n
 },\n
 /**\n
 * The width of <code>GUI</code> element\n
 * @type Number\n
 */\n
 width: {\n
 get:\n
 function() {\n
 return params.width;\n
 },\n
 set: function(v) {\n
 params.width = v;\n
 }\n
 },\n
 setWidth(_this, v);\n
 },\n
 /**\n
 * The name of <code>GUI</code>. Used for folders. i.e\n
 * a folder's name\n
 * @type String\n
 */\n
 name: {\n
 get: function() {\n
 return params.name;\n
 },\n
 set: function(v) {\n
 // TODO Check for collisions among sibling folders\n
 params.name = v;\n
 if (titleRow) {\n
 titleRow.innerHTML = params.name;\n
 }\n
 },\n
 /**\n
 * Whether\n
 the <code>GUI</code> is collapsed or not\n
 * @type Boolean\n
 */\n
 closed: {\n
 get: function() {\n
 return params.closed;\n
 },\n
 set: function(v) {\n
 params.closed = v;\n
 if (params.closed) {\n
 dom.addClass(_this.__ul, GUI.CLASS_CLOSED);\n
 } else {\n
 dom.removeClass(_this.__ul,\n
 GUI.CLASS_CLOSED);\n
 }\n
 // For browsers that aren't going to respect the CSS transition,\n
 // Lets just check our height against the window height right off\n
 // the bat.\n
 this.onResize();\n
 }\n
 },\n
 (_this.__closeButton) {\n
 _this.__closeButton.innerHTML = v ? GUI.TEXT_OPEN :\n
 GUI.TEXT_CLOSED;\n
 },\n
 /**\n
 * Contains all presets\n
 * @type Object\n
 */\n
 load: {\n
 get: function() {\n
 return params.load;\n
 },\n
 /**\n
 * Determines\n
 whether or not to use localStorage as\n
 the means for\n
 * <code>remember</code>ing\n
 * @type Boolean\n
 */\n
 useLocalStorage: {\n
 get: function() {\n
 return useLocalStorage;\n
 },\n
 set: function(bool) {\n
 if\n
 (SUPPORTS_LOCAL_STORAGE) {\n
 useLocalStorage = bool;\n
 if (bool) {\n
 dom.bind(window, 'unload', saveToLocalStorage);\n
 } else {\n
 dom.unbind(window, 'unload',\n
 saveToLocalStorage);\n
 }\n
 localStorage.setItem(getLocalStorageHash(_this, 'isLocal'), bool);\n
 }\n
 },\n
 // Are we a root level GUI?\n
 if (common.isUndefined(params.parent)) {\n
 this.closed = params.closed || false;\n
 dom.addClass(this.domElement, GUI.CLASS_MAIN);\n
 dom.makeSelectable(this.domElement, false);\n
 // Are we supposed to be loading locally?\n
 if\n
 (SUPPORTS_LOCAL_STORAGE) {\n
 if (useLocalStorage) {\n
 _this.useLocalStorage = true;\n
 const\n
 savedGui = localStorage.getItem(getLocalStorageHash(this, 'gui'));\n
 if (savedGui) {\n
 params.load =\n
 JSON.parse(savedGui);\n
 }\n
 }\n
 this.__closeButton = document.createElement('div');\n
 this.__closeButton.innerHTML = GUI.TEXT_CLOSED;\n
 dom.addClass(this.__closeButton,\n
 GUI.CLASS_CLOSE_BUTTON);\n
 if (params.closeOnTop) {\n
 dom.addClass(this.__closeButton,\n
 GUI.CLASS_CLOSE_TOP);\n
 this.domElement.insertBefore(this.__closeButton,\n
 this.domElement.childNodes[0]);\n
 } else {\n
 dom.addClass(this.__closeButton,\n
 GUI.CLASS_CLOSE_BOTTOM);\n
 this.domElement.appendChild(this.__closeButton);\n
 }\n
 dom.bind(this.__closeButton, 'click', function() {\n
 _this.closed = !_this.closed;\n
 });\n
 // Oh, you're a nested\n
 GUI!\n
 } else {\n
 if (params.closed === undefined) {\n
 params.closed = true;\n
 }\n
 const titleRowName\n
 = document.createTextNode(params.name);\n
 dom.addClass(titleRowName, 'controller-name');\n
 titleRow =\n
 addRow(_this, titleRowName);\n
 const onClickTitle = function(e) {\n
 e.preventDefault();\n
 _this.closed =\n
 !_this.closed;\n
 return false;\n
 };\n
 dom.addClass(this.__ul, GUI.CLASS_CLOSED);\n
 dom.addClass(titleRow, 'title');\n
 dom.bind(titleRow, 'click', onClickTitle);\n
 if (!params.closed) {\n
 this.closed = false;\n
 }\n
 }\n
 if (params.autoPlace) {\n
 if (common.isUndefined(params.parent)) {\n
 if\n
 (autoPlaceVirgin) {\n
 autoPlaceContainer = document.createElement('div');\n
 dom.addClass(autoPlaceContainer, CSS_NAMESPACE);\n
 dom.addClass(autoPlaceContainer,\n
 GUI.CLASS_AUTO_PLACE_CONTAINER);\n
 document.body.appendChild(autoPlaceContainer);\n
 autoPlaceVirgin = false;\n
 }\n
 // Put it in the dom for you.\n
 autoPlaceContainer.appendChild(this.domElement);\n
 // Apply the auto styles\n
 dom.addClass(this.domElement, GUI.CLASS_AUTO_PLACE);\n
 }\n
 // Make it not elastic.\n
 if

```





```

addFolder: function(name) {\n // We have to prevent collisions on names in order to have a key\n // by which
to remember saved values\n if (this.__folders[name] !== undefined) {\n throw new Error("You already have
a folder in this GUI by the' +\n ' name \'' + name + '\");\n }\n const newGuiParams = { name: name,
parent: this };\n // We need to pass down the autoPlace trait so that we can\n // attach event listeners to
open/close folder actions to\n // ensure that a scrollbar appears if the window is too short.\n newGuiParams.autoPlace = this.autoPlace;\n // Do we have saved appearance data for this folder?\n if
(this.load && // Anything loaded?\n this.load.folders && // Was my parent a dead-end?\n this.load.folders[name]) {\n // Did daddy remember me?\n // Start me closed if I was closed\n newGuiParams.closed = this.load.folders[name].closed;\n // Pass down the loaded data\n newGuiParams.load = this.load.folders[name];\n }\n const gui = new GUI(newGuiParams);\n this.__folders[name] = gui;\n const li = addRow(this, gui.domElement);\n dom.addClass(li, 'folder');\n return gui;\n },\n //**\n * Removes a subfolder GUI instance.\n * @param {dat.gui.GUI} folder The
folder to remove.\n * @instance\n */\n removeFolder: function(folder) {\n
this.__ul.removeChild(folder.domElement.parentElement);\n delete this.__folders[folder.name];\n // Do
we have saved appearance data for this folder?\n if (this.load && // Anything loaded?\n this.load.folders &&
// Was my parent a dead-end?\n this.load.folders[folder.name]) {\n delete this.load.folders[folder.name];\n
 }\n removeListeners(folder);\n const _this = this;\n common.each(folder.__folders,
function(subfolder) {\n folder.removeFolder(subfolder);\n });\n common.defer(function() {\n
_this.onResize();\n });\n },\n //**\n * Opens the GUI.\n */\n open: function() {\n this.closed =
false;\n },\n //**\n * Closes the GUI.\n */\n close: function() {\n this.closed = true;\n },\n //**\n
* Hides the GUI.\n */\n hide: function() {\n this.domElement.style.display = 'none';\n },\n //**\n *
Shows the GUI.\n */\n show: function() {\n this.domElement.style.display = '';\n },\n\n\n onResize:
function() {\n // we debounce this function to prevent performance issues when rotating on tablet/mobile\n
const root = this.getRoot();\n if (root.scrollable) {\n const top = dom.getOffset(root.__ul).top;\n let h =
0;\n common.each(root.__ul.childNodes, function(node) {\n if (!root.autoPlace && node ===
root.__save_row)) {\n h += dom.getHeight(node);\n }\n });\n if (window.innerHeight - top -
CLOSE_BUTTON_HEIGHT < h) {\n dom.addClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = window.innerHeight - top - CLOSE_BUTTON_HEIGHT + 'px';\n } else {\n dom.removeClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = 'auto';\n }\n }\n if (root.__resize_handle) {\n common.defer(function() {\n root.__resize_handle.style.height =
root.__ul.offsetHeight + 'px';\n });\n }\n if (root.__closeButton) {\n root.__closeButton.style.width =
root.width + 'px';\n }\n },\n\n\n onResizeDebounce: common.debounce(function() { this.onResize(); },
50),\n //**\n * Mark objects for saving. The order of these objects cannot change as\n * the GUI grows.
When remembering new objects, append them to the end\n * of the list.\n */\n * @param {...Object}
objects\n * @throws {Error} if not called on a top level GUI.\n * @instance\n * @ignore\n */\n remember: function() {\n if (common.isUndefined(SAVE_DIALOGUE)) {\n SAVE_DIALOGUE = new
CenteredDiv();\n SAVE_DIALOGUE.domElement.innerHTML = saveDialogueContents;\n }\n if
(this.parent) {\n throw new Error("You can only call remember on a top level GUI.");\n }\n const _this =
this;\n common.each(Array.prototype.slice.call(arguments), function(object) {\n if
(!_this.__rememberedObjects.length === 0) {\n addSaveMenu(_this);\n }\n if
(!_this.__rememberedObjects.indexOf(object) === -1) {\n _this.__rememberedObjects.push(object);\n }\n });\n if (this.autoPlace) {\n // Set save row width\n setWidth(this, this.width);\n }\n },\n\n\n //**\n * @returns {dat.gui.GUI} the topmost parent GUI of a nested GUI.\n * @instance\n */\n getRoot:
function() {\n let gui = this;\n while (gui.parent) {\n gui = gui.parent;\n }\n return gui;\n },\n\n\n //**\n * @returns {Object} a JSON object representing the current state of\n * this GUI as well as its
remembered properties.\n * @instance\n */\n getSaveObject: function() {\n const toReturn = this.load;\n toReturn.closed = this.closed;\n // Am I remembering any values?\n if (this.__rememberedObjects.length >
0) {\n toReturn.preset = this.preset;\n }\n if (!toReturn.remembered) {\n toReturn.remembered = {};\n }\n}

```



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return pc.apply(controller, args);\n };\n });\n\n dom.addClass(li, 'has-slider');\n controller.domElement.insertBefore(box.domElement, controller.domElement.firstChild);\n } else if\n (controller instanceof NumberControllerBox) {\n const r = function(returned) {\n // Have we defined both\n boundaries?\n if (common.isNumber(controller.__min) && common.isNumber(controller.__max)) {\n //\n Well, then lets just replace this with a slider.\n // lets remember if the old controller had a specific name or\n was listening\n const oldName = controller.__li.firstChild.firstChild.innerHTML;\n const\n wasListening = controller.__gui.__listening.indexOf(controller) > -1;\n controller.remove();\n const\n newController = add(\n gui,\n controller.object,\n controller.property,\n {\n before:\n controller.__li.nextElementSibling,\n factoryArgs: [controller.__min, controller.__max, controller.__step]\n });\n newController.name(oldName);\n if (wasListening) newController.listen();\n return\n newController;\n }\n return returned;\n };\n\n controller.min = common.compose(r, controller.min);\n controller.max = common.compose(r, controller.max);\n } else if (controller instanceof BooleanController) {\n dom.bind(li, 'click', function() {\n dom.fakeEvent(controller.__checkbox, 'click');\n });\n\n dom.bind(controller.__checkbox, 'click', function(e) {\n e.stopPropagation(); // Prevents double-toggle\n });\n } else if (controller instanceof FunctionController) {\n dom.bind(li, 'click', function() {\n dom.fakeEvent(controller.__button, 'click');\n });\n\n dom.bind(li, 'mouseover', function() {\n dom.addClass(controller.__button, 'hover');\n });\n\n dom.bind(li, 'mouseout', function() {\n dom.removeClass(controller.__button, 'hover');\n });\n } else if (controller instanceof ColorController) {\n dom.addClass(li, 'color');\n controller.updateDisplay = common.compose(function(val) {\n li.style.borderColor = controller.__color.toString();\n return val;\n }, controller.updateDisplay);\n\n controller.updateDisplay();\n }\n\n controller.setValue = common.compose(function(val) {\n if\n (gui.getRoot().__preset_select && controller.isModified()) {\n markPresetModified(gui.getRoot(), true);\n }\n\n return val;\n }, controller.setValue);\n}\n\nfunction recallSavedValue(gui, controller) {\n // Find the\n topmost GUI, that's where remembered objects live.\n const root = gui.getRoot();\n\n // Does the object we're\n controlling match anything we've been told to\n // remember?\n const matchedIndex =\n root.__rememberedObjects.indexOf(controller.object);\n\n // Why yes, it does!\n if (matchedIndex !== -1) {\n //\n Let me fetch a map of controllers for thcommon.isObject.\n let controllerMap =\n root.__rememberedObjectIndecesToControllers[matchedIndex];\n\n // Ohp, I believe this is the first controller\n we've created for this\n // object. Lets make the map fresh.\n if (controllerMap === undefined) {\n controllerMap = {};\n root.__rememberedObjectIndecesToControllers[matchedIndex] =\n controllerMap;\n }\n\n // Keep track of this controller\n controllerMap[controller.property] = controller;\n\n // Okay, now have\n we saved any values for this controller?\n if (root.load && root.load.remembered) {\n const presetMap =\n root.load.remembered;\n\n // Which preset are we trying to load?\n let preset;\n\n if\n (presetMap[gui.preset]) {\n preset = presetMap[gui.preset];\n } else if\n (presetMap[DEFAULT_DEFAULT_PRESET_NAME]) {\n // Uhh, you can have the default instead?\n preset = presetMap[DEFAULT_DEFAULT_PRESET_NAME];\n } else {\n // Nada.\n return;\n }\n\n // Did the loaded object remember thcommon.isObject? && Did we remember this particular property?\n if\n (preset[matchedIndex] && preset[matchedIndex][controller.property] !== undefined) {\n // We did remember\n something for this guy ...\n const value = preset[matchedIndex][controller.property];\n\n // And that's what\n it is.\n controller.initialValue = value;\n controller.setValue(value);\n }\n }\n }\n}\n\nfunction\nadd(gui, object, property, params) {\n if (object[property] === undefined) {\n throw new Error(`Object\n \"${object}\" has no property \"${property}\"`);\n }\n\n let controller;\n\n if (params.color) {\n controller = new\n ColorController(object, property);\n } else {\n const factoryArgs = [object,\n property].concat(params.factoryArgs);\n controller = ControllerFactory.apply(gui, factoryArgs);\n }\n\n if\n (params.before instanceof Controller) {\n params.before = params.before.__li;\n }\n\n recallSavedValue(gui,\n controller);\n\n dom.addClass(controller.domElement, 'c');\n const name = document.createElement('span');\n dom.addClass(name, 'property-name');\n name.innerHTML = controller.property;\n const container =\n document.createElement('div');\n container.appendChild(name);\n}

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```

container.appendChild(controller.domElement);\n\n const li = addRow(gui, container, params.before);\n\n dom.addClass(li, GUI.CLASS_CONTROLLER_ROW);\n if (controller instanceof ColorController) {\n
dom.addClass(li, 'color');\n } else {\n dom.addClass(li, typeof controller.getValue());\n }\n\n augmentController(gui, li, controller);\n\n gui.__controllers.push(controller);\n\n return controller;\n}\n\nfunction
getLocalStorageHash(gui, key) {\n // TODO how does this deal with multiple GUI's?\n return
document.location.href + '.' + key;\n}\n\nfunction addPresetOption(gui, name, setSelected) {\n const opt =
document.createElement('option');\n opt.innerHTML = name;\n opt.value = name;\n
gui.__preset_select.appendChild(opt);\n if (setSelected) {\n gui.__preset_select.selectedIndex =
gui.__preset_select.length - 1;\n }\n}\n\nfunction showHideExplain(gui, explain) {\n explain.style.display =
gui.useLocalStorage ? 'block' : 'none';\n}\n\nfunction addSaveMenu(gui) {\n const div = gui.__save_row =
document.createElement('li');\n\n dom.addClass(gui.domElement, 'has-save');\n\n gui.__ul.insertBefore(div,
gui.__ul.firstChild);\n\n dom.addClass(div, 'save-row');\n\n const gears = document.createElement('span');\n
gears.innerHTML = ' ';\n dom.addClass(gears, 'button gears');\n\n // TODO replace with
FunctionController\n const button = document.createElement('span');\n button.innerHTML = 'Save';\n
dom.addClass(button, 'button');\n dom.addClass(button, 'save');\n\n const button2 =
document.createElement('span');\n button2.innerHTML = 'New';\n dom.addClass(button2, 'button');\n
dom.addClass(button2, 'save-as');\n\n const button3 = document.createElement('span');\n button3.innerHTML =
'Revert';\n dom.addClass(button3, 'button');\n dom.addClass(button3, 'revert');\n\n const select =
gui.__preset_select = document.createElement('select');\n\n if (gui.load && gui.load.remembered) {\n
common.each(gui.load.remembered, function(value, key) {\n addPresetOption(gui, key, key === gui.preset);\n
});\n } else {\n addPresetOption(gui, DEFAULT_DEFAULT_PRESET_NAME, false);\n }\n\n dom.bind(select,
'change', function() {\n for (let index = 0; index < gui.__preset_select.length; index++) {\n
gui.__preset_select[index].innerHTML = gui.__preset_select[index].value;\n }\n\n gui.preset = this.value;\n
});\n\n div.appendChild(select);\n div.appendChild(gears);\n div.appendChild(button);\n
div.appendChild(button2);\n div.appendChild(button3);\n\n if (SUPPORTS_LOCAL_STORAGE) {\n const
explain = document.getElementById('dg-local-explain');\n const localStorageCheckBox =
document.getElementById('dg-local-storage');\n const saveLocally = document.getElementById('dg-save-
locally');\n\n saveLocally.style.display = 'block';\n\n if (localStorage.getItem(getLocalStorageHash(gui,
'isLocal')) === 'true') {\n localStorageCheckBox.setAttribute('checked', 'checked');\n }\n\n
showHideExplain(gui, explain);\n\n // TODO: Use a boolean controller, fool!\n
dom.bind(localStorageCheckBox, 'change', function() {\n gui.useLocalStorage = !gui.useLocalStorage;\n
showHideExplain(gui, explain);\n });\n }\n\n const newConstructorTextArea = document.getElementById('dg-
new-constructor');\n\n dom.bind(newConstructorTextArea, 'keydown', function(e) {\n if (e.metaKey && (e.which
=== 67 || e.keyCode === 67)) {\n SAVE_DIALOGUE.hide();\n }\n });\n\n dom.bind(gears, 'click', function()
{\n newConstructorTextArea.innerHTML = JSON.stringify(gui.getSaveObject(), undefined, 2);\n
SAVE_DIALOGUE.show();\n newConstructorTextArea.focus();\n newConstructorTextArea.select();\n });\n\n
dom.bind(button, 'click', function() {\n gui.save();\n });\n\n dom.bind(button2, 'click', function() {\n const
presetName = prompt('Enter a new preset name.);\n if (presetName) {\n gui.saveAs(presetName);\n }\n
});\n\n dom.bind(button3, 'click', function() {\n gui.revert();\n });\n\n //
div.appendChild(button2);\n}\n\nfunction addResizeHandle(gui) {\n let pmouseX;\n\n gui.__resize_handle =
document.createElement('div');\n\n common.extend(gui.__resize_handle.style, {\n\n width: '6px',\n marginLeft:
'-3px',\n height: '200px',\n cursor: 'ew-resize',\n position: 'absolute'\n // border: '1px solid blue'\n\n });\n\n
function drag(e) {\n e.preventDefault();\n\n gui.width += pmouseX - e.clientX;\n gui.onResize();\n pmouseX
= e.clientX;\n\n return false;\n }\n\n function dragStop() {\n dom.removeClass(gui.__closeButton,
GUI.CLASS_DRAG);\n dom.unbind(window, 'mousemove', drag);\n dom.unbind(window, 'mouseup',
dragStop);\n }\n\n function dragStart(e) {\n e.preventDefault();\n\n pmouseX = e.clientX;\n\n
dom.addClass(gui.__closeButton, GUI.CLASS_DRAG);\n dom.bind(window, 'mousemove', drag);\n
dom.bind(window, 'mouseup', dragStop);\n\n return false;\n }\n\n dom.bind(gui.__resize_handle, 'mousedown',

```



```

VALID_OUTPUT_STRIDES=[8,16,32];function assertValidOutputStride(e){util.assert(\`number\`===typeof
e,function(){return\`outputStride is not a
number\`}),util.assert(VALID_OUTPUT_STRIDES.indexOf(e)>=0,function(){return\`outputStride of \"+e+" is
invalid. It must be either 8, 16, or 32\`})}function assertValidResolution(e,t){util.assert(\`number\`===typeof
e,function(){return\`resolution is not a number\`}),util.assert((e-1)%t===0,function(){return\`resolution of \"+e+" is
invalid for output stride \"+t+\`.\`})}function toFloatIfInt(e){return
tidy(function(){return\`int32\`===e.dtype&&(e=e.toFloat()),e=div(e,127.5),sub(e,1)})}var
MobileNet=function(){function e(e,t){this.model=e;var r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-
1===r[2],function(){return\`Input shape [\"+r[1]+\", \"+r[2]+\"] must both be -1\`}),this.outputStride=t}return
e.prototype.predict=function(e){var t=this;return tidy(function(){var
r=toFloatIfInt(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2],a=n[3];return{heatmapScores:i.squeeze(
),sigmoid(),offsets:o.squeeze(),displacementFwd:s.squeeze(),displacementBwd:a.squeeze()}}),e.prototype.dispose
=function(){this.model.dispose(),e}();function half(e){return Math.floor(e/2)}var MaxHeap=function(){function
e(e,t){this.priorityQueue=new Array(e),this.numberOfElements=-1,this.getElementValue=t}return
e.prototype.enqueue=function(e){this.priorityQueue[++this.numberOfElements]=e,this.swim(this.numberOfElemen
ts)},e.prototype.dequeue=function(){var e=this.priorityQueue[0];return this.exchange(0,this.numberOfElements--
),this.sink(0),this.priorityQueue[this.numberOfElements+1]=null,e},e.prototype.empty=function(){return-
1===this.numberOfElements},e.prototype.size=function(){return
this.numberOfElements+1},e.prototype.all=function(){return
this.priorityQueue.slice(0,this.numberOfElements+1)},e.prototype.max=function(){return
this.priorityQueue[0]},e.prototype.swim=function(e){for(;e>0&&this.less(half(e),e);)this.exchange(e,half(e)),e=half
(e)},e.prototype.sink=function(e){for(;2*e<=this.numberOfElements;){var
t=2*e;if(t<this.numberOfElements&&this.less(t,t+1)&&t++,!this.less(e,t))break;this.exchange(e,t),e=t}},e.prototype
.getValueAt=function(e){return this.getElementValue(this.priorityQueue[e])},e.prototype.less=function(e,t){return
this.getValueAt(e)<this.getValueAt(t)},e.prototype.exchange=function(e,t){var
r=this.priorityQueue[e];this.priorityQueue[e]=this.priorityQueue[t],this.priorityQueue[t]=r,e}();function
scoreIsMaximumInLocalWindow(e,t,r,n,o,i){for(var s=i.shape,a=s[0],u=s[1],l=!0,f=Math.max(r-
o,0),c=Math.min(r+o+1,a),d=f;d<c;++d){for(var p=Math.max(n-
o,0),h=Math.min(n+o+1,u),m=p;m<h;++m)if(i.get(d,m,e)>t){l=!1;break}if(!l)break}return l}function
buildPartWithScoreQueue(e,t,r){for(var n=r.shape,o=n[0],i=n[1],s=n[2],a=new MaxHeap(o*i*s,function(e){return
e.score}),u=0;u<o;++u)for(var l=0;l<i;++l)for(var f=0;f<s;++f){var
c=r.get(u,l,f);c<e||scoreIsMaximumInLocalWindow(f,c,u,l,t,r)&&a.enqueue({score:c,part:{heatmapY:u,heatmapX:l,
id:f}})}return a}var
partNames=[\`nose\`,\`leftEye\`,\`rightEye\`,\`leftEar\`,\`rightEar\`,\`leftShoulder\`,\`rightShoulder\`,\`leftElbow\`,
\`rightElbow\`,\`leftWrist\`,\`rightWrist\`,\`leftHip\`,\`rightHip\`,\`leftKnee\`,\`rightKnee\`,\`leftAnkle\`,\`rightAn
kle\`],NUM_KEYPOINTS=partNames.length,partIds=partNames.reduce(function(e,t,r){return
e[t]=r,e},{}),connectedPartNames=[[\`leftHip\`,\`leftShoulder\`],[\`leftElbow\`,\`leftShoulder\`],[\`leftElbow\`,\`lef
tWrist\`],[\`leftHip\`,\`leftKnee\`],[\`leftKnee\`,\`leftAnkle\`],[\`rightHip\`,\`rightShoulder\`],[\`rightElbow\`,\`righ
tShoulder\`],[\`rightElbow\`,\`rightWrist\`],[\`rightHip\`,\`rightKnee\`],[\`rightKnee\`,\`rightAnkle\`],[\`leftShould
er\`,\`rightShoulder\`],[\`leftHip\`,\`rightHip\`]],poseChain=[[\`nose\`,\`leftEye\`],[\`leftEye\`,\`leftEar\`],[\`nose\`,
\`rightEye\`],[\`rightEye\`,\`rightEar\`],[\`nose\`,\`leftShoulder\`],[\`leftShoulder\`,\`leftElbow\`],[\`leftElbow\`,\`lef
tWrist\`],[\`leftShoulder\`,\`leftHip\`],[\`leftHip\`,\`leftKnee\`],[\`leftKnee\`,\`leftAnkle\`],[\`nose\`,\`rightShould
er\`],[\`rightShoulder\`,\`rightElbow\`],[\`rightElbow\`,\`rightWrist\`],[\`rightShoulder\`,\`rightHip\`],[\`rightHip\`,
\`rightKnee\`],[\`rightKnee\`,\`rightAnkle\`]],connectedPartIndices=connectedPartNames.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),partChannels=[\`left_face\`,\`right_face\`,\`right_upper_leg_front\`,\`rig
ht_lower_leg_back\`,\`right_upper_leg_back\`,\`left_lower_leg_front\`,\`left_upper_leg_front\`,\`left_upper_leg_ba
ck\`,\`left_lower_leg_back\`,\`right_feet\`,\`right_lower_leg_front\`,\`left_feet\`,\`torso_front\`,\`torso_back\`,\`rig
ht_upper_arm_front\`,\`right_upper_arm_back\`,\`right_lower_arm_back\`,\`left_lower_arm_front\`,\`left_upper_ar

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m_front\","left_upper_arm_back\","left_lower_arm_back\","right_hand\","right_lower_arm_front\","left_hand\");
function getOffsetPoint(e,t,r,n){return{y:n.get(e,t,r),x:n.get(e,t,r+NUM_KEYPOINTS)}}function
getImageCoords(e,t,r){var
n=getOffsetPoint(e.heatmapY,e.heatmapX,e.id,r),o=n.y,i=n.x;return{x:e.heatmapX*t+i,y:e.heatmapY*t+o}}function
clamp(e,t,r){return e<t?t:e>r?r:e}function squaredDistance(e,t,r,n){var o=r-e,i=n-t;return o*o+i*i}function
addVectors(e,t){return{x:e.x+t.x,y:e.y+t.y}}var parentChildrenTuples=poseChain.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),parentToChildEdges=parentChildrenTuples.map(function(e){return
e[1]}),childToParentEdges=parentChildrenTuples.map(function(e){return e[0]});function
getDisplacement(e,t,r){var n=r.shape[2]/2;return{y:r.get(t.y,t.x,e),x:r.get(t.y,t.x,n+e)}}function
getStridedIndexNearPoint(e,t,r,n){return{y:clamp(Math.round(e.y/t),0,r-1),x:clamp(Math.round(e.x/t),0,n-
1)}}function traverseToTargetKeypoint(e,t,r,n,o,i,s,a){void 0===a&&(a=2);for(var
u=n.shape,l=u[0],f=u[1],c=getDisplacement(e,getStridedIndexNearPoint(t.position,i,l,f),s),d=addVectors(t.position,c
),p=0;p<a;p++){var
h=getStridedIndexNearPoint(d,i,l,f),m=getOffsetPoint(h.y,h.x,r,o);d=addVectors({x:h.x*i,y:h.y*i},{x:m.x,y:m.y})}
var g=getStridedIndexNearPoint(d,i,l,f),_=n.get(g.y,g.x,r);return{position:d,part:partNames[r],score:_}}function
decodePose(e,t,r,n,o,i){var s=t.shape[2],a=parentToChildEdges.length,u=new
Array(s),l=e.part,f=e.score,c=getImageCoords(l,n,r);u[l.id]={score:f,part:partNames[l.id],position:c};for(var d=a-
1;d>=0;--d){var
p=parentToChildEdges[d],h=childToParentEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTargetKeypoint(d,u[p],h,t,r,n
,i))}for(d=0;d<a;++d){p=childToParentEdges[d],h=parentToChildEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTarge
tKeypoint(d,u[p],h,t,r,n,o))}return u}function withinNmsRadiusOfCorrespondingPoint(e,t,r,n){var o=r.x,i=r.y;return
e.some(function(e){var r=e.keypoints[n].position;return squaredDistance(i,o,r.y,r.x)<=t})}function
getInstanceScore(e,t,r){return r.reduce(function(r,n,o){var i=n.position,s=n.score;return
withinNmsRadiusOfCorrespondingPoint(e,t,i,o)||(r+=s),r},0)/r.length}var kLocalMaximumRadius=1;function
decodeMultiplePoses(e,t,r,n,o,i,s,a){void 0===s&&(s=.5),void 0===a&&(a=20);for(var
u=[],l=buildPartWithScoreQueue(s,kLocalMaximumRadius,e),f=a*a,u.length<i&&!l.empty()){var
c=l.dequeue();if(!withinNmsRadiusOfCorrespondingPoint(u,f.getImageCoords(c.part,o,t),c.part.id)){var
d=decodePose(c,e,t,o,r,n),p=getInstanceScore(u,f,d);u.push({keypoints:d,score:p})}}return u}var
__assign=function(){return(__assign=Object.assign||function(e){for(var t,r=1,n=arguments.length;r<n;r++)for(var o
in t=arguments[r])Object.prototype.hasOwnProperty.call(t,o)&&(e[o]=t[o]);return
e}).apply(this,arguments)};function __awaiter(e,t,r,n){return new(r||(r=Promise))(function(o,i){function
s(e){try{u(n.next(e))}catch(e){i(e)}}function a(e){try{u(n.throw(e))}catch(e){i(e)}}function
u(e){e.done?o(e.value):new r(function(t){t(e.value)}).then(s,a)}u((n=n.apply(e,t||[])).next())})}function
__generator(e,t){var r,n,o,i,s={label:0,sent:function(){if(1&o[0])throw o[1];return o[1]},trys:[],ops:[]};return
i={next:a(0),throw:a(1),return:a(2)},"function"==typeof Symbol&&(i[Symbol.iterator]=function(){return
this}),i;function a(i){return function(a){return function(i){if(r)throw new TypeError("Generator is already
executing.");for(;s;try{if(r=1,n&&(o=2&i[0]?n.return:i[0]?n.throw||((o=n.return)&&o.call(n),0):n.next)&&!o.o.c
all(n,i[1])).done)return o;switch(n=0,o&&(i=[2&i[0],o.value]),i[0]){case 0:case 1:o=i;break;case 4:return
s.label++,{value:i[1],done:!1};case 5:s.label++,n=i[1],i=[0];continue;case
7:i=s.ops.pop(),s.trys.pop();continue;default:if(!(o=(o=s.trys).length>0&&o[o.length-
1])&&(6===i[0]||2===i[0])){s=0;continue}if(3===i[0]&&(!o[i[1]]>o[0]&&i[1]<o[3])){s.label=i[1];break}if(6===i[
0]&&s.label<o[1]){s.label=o[1],o=i;break}if(o&&s.label<o[2]){s.label=o[2],s.ops.push(i);break}o[2]&&s.ops.pop(
),s.trys.pop();continue}i=t.call(e,s)}catch(e){i=[6,e],n=0}finally{r=o=0}if(5&i[0])throw
i[1];return{value:i[0]?i[1]:void 0,done:!0}}([i,a])}}function eitherPointDoesntMeetConfidence(e,t,r){return
e<r||t<r}function getAdjacentKeyPoints(e,t){return connectedPartIndices.reduce(function(r,n){var
o=n[0],i=n[1];return eitherPointDoesntMeetConfidence(e[o].score,e[i].score,t)?r:(r.push([e[o],e[i]]),r),[])}var
NEGATIVE_INFINITY=Number.NEGATIVE_INFINITY,POSITIVE_INFINITY=Number.POSITIVE_INFINITY
;function getBoundingBox(e){return e.reduce(function(e,t){var

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r=e.maxX,n=e.maxY,o=e.minX,i=e.minY,s=t.position,a=s.x,u=s.y;return{maxX:Math.max(r,a),maxY:Math.max(n,
u),minX:Math.min(o,a),minY:Math.min(i,u)},,{maxX:NEGATIVE_INFINITY,maxY:NEGATIVE_INFINITY,min
X:POSITIVE_INFINITY,minY:POSITIVE_INFINITY}}function getBoundingBoxPoints(e){var
t=getBoundingBox(e),r=t.minX,n=t.minY,o=t.maxX,i=t.maxY;return[{x:r,y:n},{x:o,y:n},{x:o,y:i},{x:r,y:i}]functi
on toTensorBuffer(e,t){return void 0===t&&(t="float32"),__awaiter(this,void 0,void 0,function(){var r;return
__generator(this,function(n){switch(n.label){case 0:return[4,e.data()];case 1:return
r=n.sent(),[2,buffer(e.shape,t,r)]}})}}function toTensorBuffers3D(e){return __awaiter(this,void 0,void
0,function(){return __generator(this,function(t){return[2,Promise.all(e.map(function(e){return
toTensorBuffer(e,"float32"))}]]}})}}function scalePose(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),{score:e.score,keypoints:e.keypoints.map(function(e){var
i=e.score,s=e.part,a=e.position;return{score:i,part:s,position:{x:a.x*r+o,y:a.y*t+n}}}})}function
scalePoses(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),l===r&&l===t&&0===n&&0===o?e:e.map(function(e){return scalePose(e,t,r,n,o)}})function
flipPoseHorizontal(e,t){return{score:e.score,keypoints:e.keypoints.map(function(e){var
r=e.score,n=e.part,o=e.position;return{score:r,part:n,position:{x:t-1-o.x,y:o.y}}}})}function
flipPosesHorizontal(e,t){return t<=0?e:e.map(function(e){return flipPoseHorizontal(e,t)}})function
getInputTensorDimensions(e){return e instanceof Tensor?[e.shape[0],e.shape[1]],[e.height,e.width]}function
toInputTensor(e){return e instanceof Tensor?e.browser.fromPixels(e)}function padAndResizeTo(e,t){var
r=t[0],s=t[1],o=getInputTensorDimensions(e),i=o[0],s=o[1],a=n/r,u=[0,0,0,0],l=u[0],f=u[1],c=u[2],d=u[3];return
s/i<a?(l=0,f=0,c=Math.round(.5*(a*i-s)),d=Math.round(.5*(a*i-s)):(l=Math.round(.5*(1/a*s-
i)),f=Math.round(.5*(1/a*s-i)),c=0,d=0),{resized:tidy(function(){var
t=toInputTensor(e);return(t=pad3d(t,[l,f],[c,d],[0,0]))).resizeBilinear([r,n]),padding:{top:l,left:c,right:d,bottom:f}
}}function scaleAndFlipPoses(e,t,r,n,o){var
i=t[0],s=t[1],a=r[0],u=r[1],l=scalePoses(e,(i+n.top+n.bottom)/a,(s+n.left+n.right)/u,-n.top,-n.left);return
o?flipPosesHorizontal(l,s):l}function mod(e,t){return tidy(function(){var r=e.div(scalar(t,"int32"));return
e.sub(r.mul(scalar(t,"int32")))}function argmax2d(e){var t=e.shape,r=t[0],n=t[1],o=t[2];return
tidy(function(){var
t=e.reshape([r*n,o]).argMax(0),i=t.div(scalar(n,"int32")).expandDims(1),s=mod(t,n).expandDims(1);return
concat([i,s],1)}function getPointsConfidence(e,t){for(var r=t.shape[0],n=new Float32Array(r),o=0;o<r;o++){var
i=t.get(o,0),s=t.get(o,1);n[o]=e.get(i,s,o)}return n}function
getOffsetPoint$(e,t,r,n){return{y:n.get(e,t,r),x:n.get(e,t,r+NUM_KEYPOINTS)}function
getOffsetVectors(e,t){for(var r=[],n=0;n<NUM_KEYPOINTS;n++){var
o=getOffsetPoint$(e.get(n,0).valueOf(),e.get(n,1).valueOf(),n,t),i=o.x,s=o.y;r.push(s),r.push(i)}return
tensor2d(r,[NUM_KEYPOINTS,2])}function getOffsetPoints(e,t,r){return tidy(function(){var
n=getOffsetVectors(e,r);return e.toTensor().mul(scalar(t,"int32")).toFloat().add(n)}function
decodeSinglePose(e,t,r){return __awaiter(this,void 0,void 0,function(){var n,o,i,s,a,u,l,f,c,d;return
__generator(this,function(p){switch(p.label){case 0:return
n=0,o=argmax2d(e),[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")]);case
1:return i=p.sent(),s=i[0],a=i[1],u=i[2],[4,toTensorBuffer(l=getOffsetPoints(u,r,a));case 2:return
f=p.sent(),c=Array.from(getPointsConfidence(s,u)),d=c.map(function(e,t){return
n+=e,{position:{y:f.get(t,0),x:f.get(t,1)},part:partNames[t],score:e}),o.dispose(),l.dispose(),[2,{keypoints:d,score:n
/d.length}]}))}}var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/mobilenet/",RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/resnet50/";function resNet50Checkpoint(e,t){var r="model-stride"+e+".json";return
4===t?RESNET50_BASE_URL+"float"+r:RESNET50_BASE_URL+"quant"+t+"^"+r}function
mobileNetCheckpoint(e,t,r){var n={1:"100",.75:"075",.5:"050"},o="model-stride"+e+".json";return
4===r?MOBILENET_BASE_URL+"float"+n[t]+"^"+o:MOBILENET_BASE_URL+"quant"+r+"^"+n[t]+"^"+
o}function toFloatIfInt$(e){return tidy(function(){return e.dtype==="int32"?e:e.toFloat();var t=tensor([-123.15,-

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115.9,-103.06));return e.add(t)}}var ResNet=function(){function e(e,t){this.model=e;var
r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-1===r[2],function(){return`Input shape [${r[1]}+`,
`${r[2]}+`] must both be equal to or -1`}),this.outputStride=t}return e.prototype.predict=function(e){var
t=this;return tidy(function(){var
r=toFloatIfInt$(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2];return{heatmapScores:n[3].squeeze().
sigmoid(),offsets:s.squeeze(),displacementFwd:o.squeeze(),displacementBwd:i.squeeze()}}),e.prototype.dispose=f
unction(){this.model.dispose(),e},MOBILENET_V1_CONFIG={architecture:`MobileNetV1`,outputStride:16,
multiplier:.75,inputResolution:257},VALID_ARCHITECTURE=[`MobileNetV1`,`ResNet50`],VALID_STRID
E={MobileNetV1:[8,16,32],ResNet50:[32,16]},VALID_INPUT_RESOLUTION=[161,193,257,289,321,353,385,41
7,449,481,513,801],VALID_MULTIPLIER={MobileNetV1:[.5,.75,1],ResNet50:[1]},VALID_QUANT_BYTES=[1
,2,4];function
validateModelConfig(e){if(null==(e=e||MOBILENET_V1_CONFIG).architecture&&(e.architecture=`MobileNetV
1`),VALID_ARCHITECTURE.indexOf(e.architecture)<0)throw new Error(`Invalid architecture
`${e.architecture}`. Should be one of
`${VALID_ARCHITECTURE}`);if(null==(e.inputResolution&&(e.inputResolution=257),VALID_INPUT_RESOLU
TION.indexOf(e.inputResolution)<0)throw new Error(`Invalid inputResolution `${e.inputResolution}`. Should be
one of
`${VALID_INPUT_RESOLUTION}`);if(null==(e.outputStride&&(e.outputStride=16),VALID_STRIDE[e.architectur
e].indexOf(e.outputStride)<0)throw new Error(`Invalid outputStride `${e.outputStride}`. Should be one of
`${VALID_STRIDE[e.architecture]}+` for architectre
`${e.architecture}`.`);if(null==(e.multiplier&&(e.multiplier=1),VALID_MULTIPLIER[e.architecture].indexOf(e.
multiplier)<0)throw new Error(`Invalid multiplier `${e.multiplier}`. Should be one of
`${VALID_MULTIPLIER[e.architecture]}+` for architectre
`${e.architecture}`.`);if(null==(e.quantBytes&&(e.quantBytes=4),VALID_QUANT_BYTES.indexOf(e.quantByte
s)<0)throw new Error(`Invalid quantBytes `${e.quantBytes}`. Should be one of `${VALID_QUANT_BYTES}`
for architectre `${e.architecture}`.`);return e}var
SINGLE_PERSON_INFERENCE_CONFIG={flipHorizontal:!1},MULTI_PERSON_INFERENCE_CONFIG={fli
pHorizontal:!1,maxDetections:5,scoreThreshold:.5,nmsRadius:20};function validateMultiPersonInputConfig(e){var
t=e.maxDetections,r=e.scoreThreshold,n=e.nmsRadius;if(t<=0)throw new Error(`Invalid maxDetections `${t}`.
Should be > 0`);if(r<0||r>1)throw new Error(`Invalid scoreThreshold `${r}`. Should be in range [0.0,
1.0]`);if(n<=0)throw new Error(`Invalid nmsRadius `${n}`.`)}var PoseNet=function(){function
e(e,t){this.baseModel=e,this.inputResolution=t}return e.prototype.estimateMultiplePoses=function(e,t){return void
0===t&&(t=MULTI_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_,I,E,v,N,y;return __generator(this,function(T){switch(T.label){case 0:return
r=__assign({},MULTI_PERSON_INFERENCE_CONFIG,t),validateMultiPersonInputConfig(t),n=this.baseModel.
outputStride,o=this.inputResolution,assertValidOutputStride(n),assertValidResolution(this.inputResolution,n),i=getI
nputTensorDimensions(e),s=i[0],a=i[1],u=padAndResizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predi
ct(l),d=c.heatmapScores,p=c.offsets,h=c.displacementFwd,m=c.displacementBwd,[4,toTensorBuffers3D([d,p,h,m])]
);case 1:return
g=T.sent(),_=g[0],I=g[1],E=g[2],v=g[3],[4,decodeMultiplePoses(_ ,I,E,v,n,r.maxDetections,r.scoreThreshold,r.nmsR
adius)];case 2:return
N=T.sent(),y=scaleAndFlipPoses(N,[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,y]}})}),e.prototype.estimateSinglePose=function(e,t){return void
0===t&&(t=SINGLE_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_;return __generator(this,function(I){switch(I.label){case 0:return
r=__assign({},SINGLE_PERSON_INFERENCE_CONFIG,t),n=this.baseModel.outputStride,o=this.inputResolutio
n,assertValidOutputStride(n),assertValidResolution(o,n),i=getInputTensorDimensions(e),s=i[0],a=i[1],u=padAndRe
sizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predict(l),d=c.heatmapScores,p=c.offsets,h=c.displacemen

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tFwd,m=c.displacementBwd,[4,decodeSinglePose(d,p,n)];case 1:return
g=I.sent(),_=scaleAndFlipPoses([g],[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,_[0]]}]})),e.prototype.estimatePoses=function(e,t){return __awaiter(this,void 0,void 0,function(){return
__generator(this,function(r){switch(r.label){case 0:return"single-
person"!=t.decodingMethod?[3,2]:[4,this.estimateSinglePose(e,t)];case 1:return[2,[r.sent()]];case
2:return[2,this.estimateMultiplePoses(e,t)]}})}),e.prototype.dispose=function(){this.baseModel.dispose()}},e);fun
ction loadMobileNet(e){return __awaiter(this,void 0,void 0,function(){var t,r,n,o,i,s;return
__generator(this,function(a){switch(a.label){case
0:if(t=e.outputStride,r=e.quantBytes,n=e.multiplier,null==tf)throw new Error("Cannot find TensorFlow.js. If you
are using a <script> tag, please also include @tensorflow/tfjs on the page before using this\n model.");return
o=mobileNetCheckpoint(t,n,r),[4,loadGraphModel(e.modelUrl||o)];case 1:return i=a.sent(),s=new
MobileNet(i,t),[2,new PoseNet(s,e.inputResolution)]}})}function loadResNet(e){return __awaiter(this,void 0,void
0,function(){var t,r,n,o,i;return __generator(this,function(s){switch(s.label){case
0:if(t=e.outputStride,r=e.quantBytes,null==tf)throw new Error("Cannot find TensorFlow.js. If you are using a
<script> tag, please also include @tensorflow/tfjs on the page before using this\n model.");return
n=resNet50Checkpoint(t,r),[4,loadGraphModel(e.modelUrl||n)];case 1:return o=s.sent(),i=new ResNet(o,t),[2,new
PoseNet(i,e.inputResolution)]}})}function load(e){return void
0===e&&(e=MOBILENET_V1_CONFIG),__awaiter(this,void 0,void 0,function(){return
__generator(this,function(t){return"ResNet50"===e.validateModelConfig(e).architecture?[2,loadResNet(e)]:"M
obileNetV1"===e.architecture?[2,loadMobileNet(e)]:[2,null]}})}export {decodeMultiplePoses,decodeSinglePose,
MobileNet,partChannels,partIds,partNames,poseChain,load,PoseNet,VALID_INPUT_RESOLUTION,getAdjacent
KeyPoints,getBoundingBox,getBoundingBoxPoints,scalePose};\n","/**\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
https://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport * as posenet from '@tensorflow-models/posenet';\nimport * as tf from '@tensorflow/tfjs-core';\n\nconst
COLOR = 'aqua';\nconst BOUNDING_BOX_COLOR = 'red';\nconst LINE_WIDTH = 2;\n\nexport const
TRY_RESNET_BUTTON_NAME = 'tryResNetButton';\nexport const TRY_RESNET_BUTTON_TEXT = '[New]
Try ResNet50';\nconst TRY_RESNET_BUTTON_TEXT_CSS = 'width:100%;text-decoration:underline;';\nconst
TRY_RESNET_BUTTON_BACKGROUND_CSS = 'background:#e61d5f;';\n\nfunction isAndroid() {\n return
/Android/i.test(navigator.userAgent);\n}\n\nfunction isiOS() {\n return
/iPhone|iPad|iPod/i.test(navigator.userAgent);\n}\n\nexport function isMobile() {\n return isAndroid() ||
isiOS();\n}\n\nfunction setDatGuiPropertyCss(propertyText, liCssString, spanCssString = "") {\n var spans =
document.getElementsByClassName('property-name');\n for (var i = 0; i < spans.length; i++) {\n var text =
spans[i].textContent || spans[i].innerText;\n if (text == propertyText) {\n spans[i].parentNode.parentNode.style
= liCssString;\n if (spanCssString !== "") {\n spans[i].style = spanCssString;\n }\n }\n}\n}\n\nexport
function updateTryResNetButtonDatGuiCss() {\n setDatGuiPropertyCss(\n TRY_RESNET_BUTTON_TEXT,\n
TRY_RESNET_BUTTON_BACKGROUND_CSS,\n TRY_RESNET_BUTTON_TEXT_CSS);\n}\n}\n\n/**\n *
Toggles between the loading UI and the main canvas UI.\n *\nexport function toggleLoadingUI(\n
showLoadingUI, loadingDivId = 'loading', mainDivId = 'main') {\n if (showLoadingUI) {\n
document.getElementById(loadingDivId).style.display = 'block';\n
document.getElementById(mainDivId).style.display = 'none';\n } else {\n
document.getElementById(loadingDivId).style.display = 'none';\n
document.getElementById(mainDivId).style.display = 'block';\n }\n}\n\nexport function drawPoint(ctx, y, x, r,

```





```

'video': videoConstraints});\n videoElement.srcObject = stream;\n\n return new Promise((resolve) => {\n
videoElement.onloadedmetadata = () => {\n videoElement.width = videoElement.videoWidth;\n
videoElement.height = videoElement.videoHeight;\n resolve(videoElement);\n });\n});\n\n\nasync function
loadVideo(cameraLabel) {\n try {\n state.video = await setupCamera(cameraLabel);\n } catch (e) {\n let info =
document.getElementById('info');\n info.textContent = 'this browser does not support video capture,' +\n 'or
this device does not have a camera';\n info.style.display = 'block';\n throw e;\n }}\n\n
state.video.play();\n});\n\n\nconst defaultQuantBytes = 2;\n\nconst defaultMobileNetMultiplier = isMobile() ? 0.50 :
0.75;\n\nconst defaultMobileNetStride = 16;\n\nconst defaultMobileNetInternalResolution = 'medium';\n\nconst
defaultResNetMultiplier = 1.0;\n\nconst defaultResNetStride = 16;\n\nconst defaultResNetInternalResolution =
'low';\n\nconst guiState = {\n algorithm: 'multi-person-instance',\n estimate: 'partmap',\n camera: null,\n
flipHorizontal: true,\n input: {\n architecture: 'MobileNetV1',\n outputStride: 16,\n internalResolution: 'low',\n
multiplier: 0.50,\n quantBytes: 2\n },\n multiPersonDecoding: {\n maxDetections: 5,\n scoreThreshold:
0.3,\n nmsRadius: 20,\n numKeypointForMatching: 17,\n refineSteps: 10\n },\n segmentation: {\n
segmentationThreshold: 0.7,\n effect: 'mask',\n maskBackground: true,\n opacity: 0.7,\n
backgroundBlurAmount: 3,\n maskBlurAmount: 0,\n edgeBlurAmount: 3\n },\n partMap: {\n colorScale:
'rainbow',\n effect: 'partMap',\n segmentationThreshold: 0.5,\n opacity: 0.9,\n blurBodyPartAmount: 3,\n
bodyPartEdgeBlurAmount: 3\n },\n showFps: !isMobile()\n};\n\n\nfunction toCameraOptions(cameras) {\n const
result = {default: null};\n\n cameras.forEach(camera => {\n result[camera.label] = camera.label;\n });\n\n return
result;\n});\n\n\n/**\n * Sets up dat.gui controller on the top-right of the window\n */\n\nfunction setupGui(cameras) {\n
const gui = new dat.GUI({width: 300});\n\n let architectureController = null;\n
guiState[TRY_RESNET_BUTTON_NAME] = function() {\n architectureController.setValue('ResNet50')\n };
gui.add(guiState, TRY_RESNET_BUTTON_NAME).name(TRY_RESNET_BUTTON_TEXT);\n
updateTryResNetButtonDatGuiCss();\n\n gui.add(guiState, 'camera', toCameraOptions(cameras))\n
.onChange(async function(cameraLabel) {\n state.changingCamera = true;\n\n await
loadVideo(cameraLabel);\n\n state.changingCamera = false;\n });\n\n gui.add(guiState, 'flipHorizontal');\n\n
// There are two algorithms 'person' and 'multi-person-instance'.\n // The 'person' algorithm returns one single
segmentation mask (or body\n // part map) for all people in the image. The 'multi-person-instance'\n // algorithm
returns an array of segmentation mask (or body part map).\n // Each element in the array corresponding to one of
the people. In other\n // words, 'multi-person-instance' algorithm does instance-level person\n // segmentation and
body part segmentation for every person in the image.\n const algorithmController =\n gui.add(guiState,
'algorithm', ['person', 'multi-person-instance']);\n\n // Architecture: there are a few BodyPix models varying in size
and\n // accuracy.\n // The input parameters have the most effect on accuracy and speed of the\n // network\n let
input = gui.addFolder('Input');\n\n // Updates outputStride\n // Output stride: Internally, this parameter affects the
height and width\n // of the layers in the neural network. The lower the value of the output\n // stride the higher the
accuracy but slower the speed, the higher the\n // value the faster the speed but lower the accuracy.\n let
outputStrideController = null;\n function updateGuiOutputStride(outputStride, outputStrideArray) {\n if
(outputStrideController) {\n outputStrideController.remove();\n }\n guiState.input.outputStride =
outputStride;\n outputStrideController =\n input.add(guiState.input, 'outputStride', outputStrideArray);\n
outputStrideController.onChange(function(outputStride) {\n state.changingStride = true;\n
guiState.input.outputStride = +outputStride;\n });\n });\n\n // Updates internal resolution\n // Internal resolution:
Internally, this parameter affects the height and\n // width of the layers in the neural network. The higher the value
of the\n // internal resolution the better the accuracy but slower the speed.\n let internalResolutionController =
null;\n function updateGuiInternalResolution(\n internalResolution,\n internalResolutionArray,\n) {\n if
(internalResolutionController) {\n internalResolutionController.remove();\n }\n
guiState.input.internalResolution = internalResolution;\n internalResolutionController = input.add(\n
guiState.input, 'internalResolution', internalResolutionArray);\n
internalResolutionController.onChange(function(internalResolution) {\n guiState.input.internalResolution =
internalResolution;\n });\n });\n\n // Updates depth multiplier\n // Multiplier: this parameter affects the number of

```

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feature map channels\n // in the MobileNet. The higher the value, the higher the accuracy but\n // slower the speed,
the lower the value the faster the speed but lower\n // the accuracy.\n let multiplierController = null;\n function
updateGuiMultiplier(multiplier, multiplierArray) {\n if (multiplierController) {\n
multiplierController.remove();\n }\n guiState.input.multiplier = multiplier;\n multiplierController =\n
input.add(guiState.input, 'multiplier', multiplierArray);\n multiplierController.onChange(function(multiplier) {\n
state.changingMultiplier = true;\n guiState.input.multiplier = +multiplier;\n });\n }\n\n // updates quantBytes\n
// QuantBytes: this parameter affects weight quantization in the ResNet50\n // model. The available options are 1
byte, 2 bytes, and 4 bytes. The\n // higher the value, the larger the model size and thus the longer the\n // loading
time, the lower the value, the shorter the loading time but\n // lower the accuracy.\n let quantBytesController =
null;\n function updateGuiQuantBytes(quantBytes, quantBytesArray) {\n if (quantBytesController) {\n
quantBytesController.remove();\n }\n guiState.quantBytes = +quantBytes;\n guiState.input.quantBytes =
+quantBytes;\n quantBytesController =\n input.add(guiState.input, 'quantBytes', quantBytesArray);\n
quantBytesController.onChange(function(quantBytes) {\n state.changingQuantBytes = true;\n
guiState.input.quantBytes = +quantBytes;\n });\n }\n\n function updateGuiInputSection() {\n if
(guiState.input.architecture === 'MobileNetV1') {\n updateGuiInternalResolution(\n
defaultMobileNetInternalResolution,\n ['low', 'medium', 'high', 'full']);\n
updateGuiOutputStride(defaultMobileNetStride, [8, 16]);\n updateGuiMultiplier(defaultMobileNetMultiplier,
[0.50, 0.75, 1.0])\n } else { // guiState.input.architecture === 'ResNet50'\n updateGuiInternalResolution(\n
defaultResNetInternalResolution, ['low', 'medium', 'high', 'full']);\n
updateGuiOutputStride(defaultResNetStride, [32, 16]);\n updateGuiMultiplier(defaultResNetMultiplier, [1.0]);\n
}\n updateGuiQuantBytes(defaultQuantBytes, [1, 2, 4]);\n }\n\n // Architecture: there are a few PoseNet models
varying in size and\n // accuracy. 1.01 is the largest, but will be the slowest. 0.50 is the\n // fastest, but least
accurate.\n architectureController =\n input.add(guiState.input, 'architecture', ['ResNet50', 'MobileNetV1']);\n
guiState.architecture = guiState.input.architecture;\n architectureController.onChange(function(architecture) {\n //
if architecture is ResNet50, then show ResNet50 options\n state.changingArchitecture = true;\n
guiState.input.architecture = architecture;\n updateGuiInputSection();\n });\n\n updateGuiInputSection();\n
input.open()\n\n const estimateController =\n gui.add(guiState, 'estimate', ['segmentation', 'partmap']);\n\n let
segmentation = gui.addFolder('Segmentation');\n segmentation.add(guiState.segmentation, 'segmentationThreshold',
0.0, 1.0);\n const segmentationEffectController =\n segmentation.add(guiState.segmentation, 'effect', ['mask',
'bokeh']);\n\n let multiPersonDecoding = gui.addFolder('MultiPersonDecoding');\n multiPersonDecoding.add(\n
guiState.multiPersonDecoding, 'maxDetections', 0, 20, 1);\n multiPersonDecoding.add(\n
guiState.multiPersonDecoding, 'scoreThreshold', 0.0, 1.0);\n
multiPersonDecoding.add(guiState.multiPersonDecoding, 'nmsRadius', 0, 30, 1);\n multiPersonDecoding.add(\n
guiState.multiPersonDecoding, 'numKeypointForMatching', 1, 17, 1);\n multiPersonDecoding.add(\n
guiState.multiPersonDecoding, 'refineSteps', 1, 10, 1);\n multiPersonDecoding.open();\n\n
algorithmController.onChange(function(value) {\n switch (guiState.algorithm) {\n case 'single-person':\n
multiPersonDecoding.close();\n singlePersonDecoding.open();\n break;\n case 'multi-person':\n
singlePersonDecoding.close();\n multiPersonDecoding.open();\n break;\n }\n });\n\n let
darknessLevel;\n let bokehBlurAmount;\n let edgeBlurAmount;\n let maskBlurAmount;\n let
maskBackground;\n\n segmentationEffectController.onChange(function(effectType) {\n if (effectType ===
'mask') {\n if (bokehBlurAmount) {\n bokehBlurAmount.remove();\n }\n if (edgeBlurAmount) {\n
edgeBlurAmount.remove();\n }\n darknessLevel =\n segmentation.add(guiState.segmentation, 'opacity',
0.0, 1.0);\n maskBlurAmount = segmentation.add(guiState.segmentation, 'maskBlurAmount')\n
.min(0)\n .max(20)\n .step(1);\n maskBackground =\n
segmentation.add(guiState.segmentation, 'maskBackground');\n } else if (effectType === 'bokeh') {\n if
(darknessLevel) {\n darknessLevel.remove();\n }\n if (maskBlurAmount) {\n
maskBlurAmount.remove();\n }\n if (maskBackground) {\n maskBackground.remove();\n }\n
bokehBlurAmount = segmentation\n .add(\n guiState.segmentation,\n

```

```

 'backgroundBlurAmount',\n
 .step(1);\n
 edgeBlurAmount = segmentation.add(guiState.segmentation, 'edgeBlurAmount')\n
 .min(0)\n
 .max(20)\n
 .step(1);\n
 }\n
 });\n
 \n
 // manually set the effect so
that the options are shown.\n
segmentationEffectController.setValue(guiState.segmentation.effect);\n
\n
let partMap
= gui.addFolder('Part Map');\n
partMap.add(guiState.partMap, 'segmentationThreshold', 0.0, 1.0);\n
partMap.add(\n
 guiState.partMap, 'effect', ['partMap', 'pixelation', 'blurBodyPart']);\n
partMap.add(guiState.partMap, 'opacity', 0.0, 1.0);\n
partMap.add(guiState.partMap, 'colorScale',
Object.keys(partColorScales))\n
 .onChange(colorScale => {\n
 setShownPartColorScales(colorScale);\n
 });\n
setShownPartColorScales(guiState.partMap.colorScale);\n
partMap.add(guiState.partMap,
'blurBodyPartAmount').min(1).max(20).step(1);\n
partMap.add(guiState.partMap, 'bodyPartEdgeBlurAmount')\n
.min(1)\n
.max(20)\n
.step(1);\n
partMap.open();\n
\n
estimateController.onChange(function(estimationType)
{\n
 if (estimationType === 'segmentation') {\n
 segmentation.open();\n
 partMap.close();\n
 document.getElementById('colors').style.display = 'none';\n
 } else {\n
 segmentation.close();\n
 partMap.open();\n
 document.getElementById('colors').style.display = 'inline-block';\n
 }\n
});\n
\n
gui.add(guiState, 'showFps').onChange(showFps => {\n
 if (showFps) {\n
 document.body.appendChild(stats.dom);\n
 } else {\n
 document.body.removeChild(stats.dom);\n
 }\n
});\n
\n
function setShownPartColorScales(colorScale) {\n
 const colors = document.getElementById('colors');\n
 colors.innerHTML = '';\n
 const partColors = partColorScales[colorScale];\n
 const partNames =
bodyPix.PART_CHANNELS;\n
 for (let i = 0; i < partColors.length; i++) {\n
 const partColor = partColors[i];\n
 const child = document.createElement('li');\n
 child.innerHTML = `
<div class='color' style='background-
color:rgb(${partColor[0]},${\n
 partColor[1]},${partColor[2]})' ></div>
 ${partNames[i]}`;\n
 colors.appendChild(child);\n
 }\n
}\n
\n
**\n
* Sets up a frames per second panel on the top-left of the window\n
*\n
function setupFPS() {\n
 stats.showPanel(0); // 0: fps, 1: ms, 2: mb, 3+: custom\n
 if (guiState.showFps) {\n
 document.body.appendChild(stats.dom);\n
 }\n
}\n
\n
function estimateSegmentation() {\n
 let
multiPersonSegmentation = null;\n
 switch (guiState.algorithm) {\n
 case 'multi-person-instance':\n
 return await
state.net.segmentMultiPerson(state.video, {\n
 internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
 maxDetections:
guiState.multiPersonDecoding.maxDetections,\n
 scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n
 nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
numKeypointForMatching:
guiState.multiPersonDecoding.numKeypointForMatching,\n
 refineSteps:
guiState.multiPersonDecoding.refineSteps\n
 });\n
 case 'person':\n
 return await
state.net.segmentPerson(state.video, {\n
 internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
 maxDetections:
guiState.multiPersonDecoding.maxDetections,\n
 scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n
 nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
 });\n
 default:\n
 break;\n
 }\n
 return multiPersonSegmentation;\n
}\n
\n
function
estimatePartSegmentation() {\n
 switch (guiState.algorithm) {\n
 case 'multi-person-instance':\n
 return await
state.net.segmentMultiPersonParts(state.video, {\n
 internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
 maxDetections:
guiState.multiPersonDecoding.maxDetections,\n
 scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n
 nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
numKeypointForMatching:
guiState.multiPersonDecoding.numKeypointForMatching,\n
 refineSteps:
guiState.multiPersonDecoding.refineSteps\n
 });\n
 case 'person':\n
 return await
state.net.segmentPersonParts(state.video, {\n
 internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
 maxDetections:
guiState.multiPersonDecoding.maxDetections,\n
 scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n
 nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
 });\n
 default:\n
 break;\n
 }\n
 return multiPersonPartSegmentation;\n
}\n
\n
function

```





```
navigator.webkitGetUserMedia || navigator.mozGetUserMedia;\n// kick off the demo\nbindPage();\n"}}
```

Found in path(s):

```
* /opt/cola/permits/1234600288_1638275149.74/0/tensorflow-models-zip/@tensorflow-models/body-pix/demos/dist/demos.ab0c720b.js.map
```

# 1.179 xorg-randr 1.5.0

## 1.179.1 Available under license :

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# 1.180 @tensorflow/tfjs-backend-wasm 3.11.0

## 1.180.1 Available under license :

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

```
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```

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AAM;IACnB,SAAS,EAAE,KAAK;IACbB,UAAU,EAAE,QAAQ;CACrB,CAAC","sourcesContent":["/\*\n \*  
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the specific language governing permissions and\n \* limitations under the License.\n \*  
=====\n

```
*\n\nimport { gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //
sliceSize\n 'array', // strides\n 'number' // outId\n]);\n\n function gatherNd(args: { backend: BackendWasm,
inputs: GatherNdInputs}): TensorInfo {\n const { backend, inputs } = args;\n const { params, indices } =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n }\n\n export const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-  
wasm/dist/kernels/GatherNd.js.map

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

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```



```

concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\nbackend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =
inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,
inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\nbackend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const
outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n }\n\n const batchSize = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b <
batchSize; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n }\n return
out;\n}\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n};\n}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Concat.js.map

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

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: { inputs: SelectInputs, backend: BackendWasm }) {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 : 0;\n util.sizeFromShape(t.shape.slice(1));\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n }\n\n export const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as KernelFunc,\n setupFunc: setup\n };"}\n\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.js.map

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

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```

const t = tf.tensor(view);\n // Tensor values should match.\n test_util.expectArraysClose(await t.data(), view);\n
});\n});\n\nndescribeWithFlags('wasm init', BROWSER_ENVS, () => {\n beforeEach(() => {\n
registerBackend('wasm-test', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n }, 100);\n\n // Silences backend registration warnings.\n spyOn(console, 'warn');\n
spyOn(console, 'log');\n });\n\n afterEach(() => {\n resetWasmPath();\n removeBackend('wasm-test');\n });\n\n
it('backend init fails when the path is invalid', async () => {\n setWasmPath('invalid/path');\n let wasmPath:
string;\n const realFetch = fetch;\n spyOn(self, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n
return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(false);\n
expect(wasmPath).toBe('invalid/path');\n });\n\n it('backend init fails when setWasmPaths is called with ' +\n
'an invalid prefix',\n async () => {\n setWasmPaths('invalid/prefix/');\n let wasmPath: string;\n const
realFetch = fetch;\n spyOn(self, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return
realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(false);\n
expect(wasmPath).toContain('invalid/prefix');\n });\n\n it('backend init fails when setWasmPaths is called with '
+\n 'an invalid fileMap',\n async () => {\n setWasmPaths({\n 'tfjs-backend-wasm.wasm':
'invalid/path',\n 'tfjs-backend-wasm-simd.wasm': 'invalid/path',\n 'tfjs-backend-wasm-threaded-
simd.wasm': 'invalid/path'\n });\n let wasmPathPrefix: string;\n const realFetch = fetch;\n spyOn(self,
'fetch').and.callFake((path: string) => {\n wasmPathPrefix = path;\n return realFetch(path);\n });\n
expect(await tf.setBackend('wasm-test')).toBe(false);\n expect(wasmPathPrefix).toBe('invalid/path');\n });\n\n
it('setWasmPaths throws error when called without specifying a path for ' +\n 'each binary',\n async () => {\n
expect(() => {\n setWasmPaths({\n 'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-
wasm.wasm'\n });\n }).toThrow();\n });\n\n it('backend init works when the path is valid and use
platform fetch',\n async () => {\n const usePlatformFetch = true;\n const validPrefix = '/base/wasm-out/';\n
setWasmPaths(validPrefix, usePlatformFetch);\n let wasmPath: string;\n const realFetch = util.fetch;\n
spyOn(util, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n return realFetch(path);\n
});\n expect(await tf.setBackend('wasm-test')).toBe(true);\n const validPaths = new Set([\n validPrefix +
'tfjs-backend-wasm.wasm',\n validPrefix + 'tfjs-backend-wasm-simd.wasm',\n validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n]);\n expect(validPaths).toContain(wasmPath);\n });\n\n it('backend init
works when the wasm paths overrides map is valid and ' +\n 'using platform fetch',\n async () => {\n
const usePlatformFetch = true;\n const validPrefix = '/base/wasm-out/';\n setWasmPaths(\n {\n
'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-wasm.wasm',\n 'tfjs-backend-wasm-simd.wasm':\n
'/base/wasm-out/tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm':\n
'/base/wasm-out/tfjs-backend-wasm-threaded-simd.wasm'\n },\n usePlatformFetch);\n let
wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n
wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-
test')).toBe(true);\n const validPaths = new Set([\n validPrefix + 'tfjs-backend-wasm.wasm',\n
validPrefix + 'tfjs-backend-wasm-simd.wasm',\n validPrefix + 'tfjs-backend-wasm-threaded-simd.wasm',\n
]);\n expect(validPaths).toContain(wasmPath);\n });\n\n it('backend init works when the path is valid and use
platform fetch',\n async () => {\n const usePlatformFetch = true;\n const validPath = '/base/wasm-out/tfjs-
backend-wasm.wasm';\n setWasmPath(validPath, usePlatformFetch);\n let wasmPath: string;\n const
realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n wasmPath = path;\n
return realFetch(path);\n });\n expect(await tf.setBackend('wasm-test')).toBe(true);\n
expect(wasmPath).toBe(validPath);\n });\n\n // Disabling this test because it intermittently times out on CI.\n //
tslint:disable-next-line: ban\n it('backend init fails when the path is invalid and use platform fetch',\n async ()
=> {\n const usePlatformFetch = true;\n setWasmPath('invalid/path', usePlatformFetch);\n let
wasmPath: string;\n const realFetch = util.fetch;\n spyOn(util, 'fetch').and.callFake((path: string) => {\n
wasmPath = path;\n return realFetch(path);\n });\n expect(await tf.setBackend('wasm-
test')).toBe(false);\n expect(wasmPath).toBe('invalid/path');\n });\n\n it('backend init succeeds with default
path', async () => {\n expect(await tf.setBackend('wasm-test')).toBe(true);\n });\n\n it('setWasmPath called too

```



\* limitations under the License.

\* =====  
\*/

Found in path(s):

- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/test\_node.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test\_node.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test\_node.js

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

```

{"version":3,"file":"FusedBatchNorm.js","sourceRoot":"","sources":["../src/kernels/FusedBatchNorm.ts"],"names":
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C,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IACrD,MAAM,UAAU,GAAG,
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kC;CAC/C,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number', 'number'];\n)\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =

```

```
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const\noffsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?\nbackend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-\ncircuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =\nbackend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,\nvarianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:\nFusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as\nKernelFunc\n};\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-\nwasm/dist/kernels/FusedBatchNorm.js.map
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No license file was found, but licenses were detected in source scan.

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```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-\nwasm/dist/kernel_utils/shared.js.map
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No license file was found, but licenses were detected in source scan.

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WAA+B;CAC5C,CAAC", "sourcesContent":["/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights  
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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*  
=====\n \*\n \*\nimport {backend\_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,  
Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend\_wasm';\nimport  
{FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight:  
number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,  
padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,  
dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number,

```

leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n
'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n
'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } =
attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as
Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n
FusableActivation[activation as {}] as keyof typeof FusableActivation;\n\n if (fusedActivation == null) {\n throw
new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if
(bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n `FusedConv2D only supports rank-1 bias but got ` +\n `rank
${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels
(${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/FusedConv2D.js.map

```

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```

/**

```

```

* @license

```

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- \* =====
- \*/

Found in path(s):

- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernel\_utils/shared.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Pack.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OneHot.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/register\_all\_kernels.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SplitV.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OnesLike.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ZerosLike.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Prod.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Step.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV4.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Equal.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/flags\_wasm.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Floor.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-



wasm/dist/kernels/Conv2DBackpropInput.d.ts  
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wasm/src/kernels/Cumsum.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-  
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wasm/dist/base.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-  
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wasm/dist/kernels/Floor.js  
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wasm/src/kernels/Softmax.ts  
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wasm/dist/kernels/OneHot.d.ts

- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OnesLike.d.ts
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/register\_all\_kernels.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.js
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Softmax.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Mean.ts
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV4.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Equal.ts
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- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernel\_utils/shared.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Fill.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.d.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Identity.ts
- \* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/OneHot.ts

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AO;QACP,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ,CAAG,SAAS;KACrB,CAAC,CAAC;AACL,CAA
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CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/C,MAAM,EAAC,I
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```





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```

```
setup\n};\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.js.map
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```

```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js.map
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No license file was found, but licenses were detected in source scan.

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```

```
=====\n*\nimport './flags_wasm';\nimport {registerBackend} from '@tensorflow/tfjs-core';\nimport {BackendWasm, init} from './backend_wasm';\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';\nexport {version as version_wasm} from './version';\nconst WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new BackendWasm(wasm);\n}, WASM_PRIORITY);\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.js.map
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No license file was found, but licenses were detected in source scan.

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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Greater.js.map
```

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

```
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the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n *\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};\n}\n"]}
```

Found in path(s):





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ChB,UAAU,EAAE,mBAAuC;CACpD,CAAC", "sourcesContent": ["/\*\n \* @license\n \* Copyright 2020 Google  
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use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*  
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*\n  
=====\n \*\n\nimport { backend\_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,  
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from  
'./backend\_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,  
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,  
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:  
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:  
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //  
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //  
outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //  
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', //  
fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //  
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', //  
yChannelStride\n 'number', // outId\n ]);\n\nfunction conv2DBackpropInput(args: {\n backend:  
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat,  
dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n const \$dataFormat =  
backend\_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend\_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,  
false /\* depthwise \*/, \$dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =  
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -  
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =  
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,

```

fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2,\n xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
conv2DBackpropInput as { } as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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EAAE,KAAK;CACjB,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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```

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```
=====\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n\n function argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n }\n\n export const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n };"}\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.js.map

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```
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```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Any.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/BatchToSpaceND.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/All.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Any.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Ceil.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Elu.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/StridedSlice.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/StridedSlice.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Any.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/StridedSlice.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Round.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/All.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tan.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MirrorPad.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.min.js



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```
=====\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { FusibleActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //\n leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs:\n _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const { inputs, backend,\n attrs } = args;\n const { a, b, bias, preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==\n 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank\n ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId =\n preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const\n fusedActivation =\n FusibleActivation[activation as { } as keyof typeof FusibleActivation];\n if\n (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for\n FusedConv2D ` +\n `in the wasm backend.`);\n }\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out =\n backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/\_FusedMatMul.js.map

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

```
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```



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```
=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(args: { backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs }): TensorInfo {\n const { backend, inputs, attrs } = args;\n
const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n
permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes,
inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const minConfig: KernelConfig = {\n
kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as KernelFunc\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Min.js.map

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

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```
=====
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} =
attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if
(dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank}]);\n $dim = inputRank + dim
+ 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape:
newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/ExpandDims.js.map
```

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

```
{"version":3,"file":"Tanh.js","sourceRoot":"","sources":["../../src/kernels/Tanh.ts"],"names":[],"mappings":"AAAA;
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AC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
```

```
=====
*\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Tanh.js.map
```

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```
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```

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* =====

```

```

*/
/**
* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `wasm` file which will be fetched when the wasm
* backend is initialized. See
* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
* for more details.
* @param path wasm file path or url
* @param usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/backend_wasm.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/backend_wasm.d.ts
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js
No license file was found, but licenses were detected in source scan.

```

```

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the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
// Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n
wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',
setupFunc, kernelFunc};\n}\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```

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

```

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```
=====\n*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number, extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number', // out id\n]);\n\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { method, extrapolationValue, cropSize } = attrs;\n const { image, boxes, boxInd } = inputs;\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData = backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData = cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n imagesData = backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n extrapolationValue, outId);\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n\n export const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n };
}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.js.map

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

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)\n=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n\n function kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n return selectedIndicesTensor;\n }\n\n export const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.js.map

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

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {identity} from
'./Identity';\nimport {CppType} from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,
xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /*
void*/, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n\n export function transpose(\n args:\n {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs});\n TensorInfo {\n const {inputs,
backend, attrs} = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better
```

```

due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,
attrs.perm);\n\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n
permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n
dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n }; \n\n if (permIsNoOp) {\n const
cloned = identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n
return outShape;\n}\n\nfunction removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]]
{\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n
 if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n
newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j =
0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] >
newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape,
newPerm];\n}\n\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName:
'wasm',\n kernelFunc: transpose as {} as KernelFunc,\n setupFunc: setup,\n};\n"}

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Found in path(s):

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Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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```







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

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
```



```
wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',\n setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n compliance with the License.\n * You may obtain a copy of the License at\n * \n
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```
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```

```
=====\n *\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n *\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\n\nexport\n function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:\n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): \n TensorInfo {\n const {backend,\n inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =\n backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =\n backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,\n outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return\n out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =\n new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if\n (supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const\n aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =\n backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>\n v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&\n loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting\n along outer dims is not yet `+\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return\n {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

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=====
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n",/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n\n function addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n return out;\n }\n\n export const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n };
\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====

```

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=====
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\n export const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as {} as
KernelFunc,\n };
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====

```

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=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
 './Identity';\n\nimport {CppType} from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,
xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) =>

```

```

void;
function setup(backend: BackendWasm) {
 wasmTranspose = backend.wasm.cwrap(Transpose, null /*
void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n
'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);
}
export function transpose(\n args:\n
 {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):\n TensorInfo {\n const {inputs,
backend, attrs} = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better
due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,
attrs.perm);\n \n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n
permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n
dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };
\n if (permIsNoOp) {\n const
cloned = identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n \n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n wasmTranspose(\n xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
out;\n}
function computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }
\n return outShape;\n}
function removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]]
{\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if
(shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n
newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j =
0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] >
newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape,
newPerm];\n}
export const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName:
'wasm',\n kernelFunc: transpose as {} as KernelFunc,\n setupFunc: setup,\n};
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';
import {BackendWasm} from
'./backend_wasm';
import {transpose} from './Transpose';
/**\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n *
@param backend wasm backend instance\n */
export function permuteAxesAndTranspose(\n x: TensorInfo,
axis: number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n
originalAxes: number[],\n inputWasTransposed: boolean\n } {\n const xShape = x.shape;\n const xRank =
x.shape.length;\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let
inputWasTransposed = false;\n if (permutedAxes !== null) {\n const newShape: number[] = new Array(xRank);\n
for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
 }\n }\n return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n}
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```
=====\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:\n number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null\n /*void*/, ['number, number, number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs:\n AllAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}\n = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if\n (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =\n transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:\n number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,\n null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,\n attrs: AnyAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims}\n = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis,\n backend);\n\n if\n (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =\n transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:\n
```

setup,\n kernelFunc: any as { } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n\n function argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n }\n\n export const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n };\n }\n\n "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n */\n\n }\n}
```

```
=====\n*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n\n function avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs, backend } = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const\n }\n}
```



```

padRight = convInfo.padInfo.right;\n const paddingBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend
only supports average pooling with dilation = [1, 1],` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, paddingBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as { } as KernelFunc\n};\n", "/**\n * @license\n
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the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n args: { inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } =
inputs;\n const { shape } = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n
return { dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n", "/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { reshape } from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number' // out_id\n]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { a, b } = inputs;\n
const { transposeA, transposeB } = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -

```





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gICAgIH1cblxuICAgICAgY29sT2Zmc2V0ICs9IGlucHV0LnNoYXBIWzFdO1xuICAgIH0pO1xuICB9XG5cbiAgc  
mV0dXJuIG91dFZhbHM7XG59XG4iXX0=","/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights  
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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```
\n * \nimport { util } from '@tensorflow/tfjs-core';\nexport function rangeImpl(start, stop, step, dtype) {\n const\n sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const\n decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n }\n const numElements\n = Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\n if (stop < start && step === 1) {\n // Auto adjust the step's sign if it hasn't been set\n // (or was set to 1)\n step = -1;\n }\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] +\n step;\n }\n return values;\n}\n
```

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*  
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```
{x}, backend, attrs: {shape: reshaped});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,\n attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,\n attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return\n result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

```

```
=====\n\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\n cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm};\n TensorInfo {\n const {inputs:\n {x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =\n backendtypedArrayFromHeap(x);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n })\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *

```

```
=====\n\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n '../unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

```

```
=====\n\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\n number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =\n backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //\n max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:\n BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId,\n clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as { } as\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the

```

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```
=====
*
\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';
\nimport { BackendWasm } from './backend_wasm';
\nimport { concatImplCPU } from './kernel_utils/shared';
\nimport { identity } from './Identity';
\nimport { reshape } from './Reshape';
\nexport function
concat(\n args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs }) {\n const { inputs, backend }
= args;
\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];
\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);
\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).
\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);
\n if ($inputs.length ===
1) {\n return identity({ inputs: { x: $inputs[0] }, backend });
\n }
\n const out = backend.makeOutput(outShape,
inputs[0].dtype);
\n if (util.sizeFromShape(outShape) === 0) {\n return out;
\n }
\n const shapes =
$inputs.map(t => t.shape);
\n backend_util.assertParamsConsistent(shapes, axis);
\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to
// a concatenation of two-dimensional tensors across the axis 1 by first
// partitioning the axes of the original tensors into those less than
// axis to be concatenated and the rest. Then reshape the tensors
// into a two-dimensional tensor by collapsing these two sets of axes and
// concatenate the resulting matrices across the axis 1, finally reshaping
// the result to have the proper shape.
\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));
 const shape = [-1, innerSize];
 return reshape({ inputs: { x: t },
backend, attrs: { shape } });
\n });
\n const inputsValShapes = inputs2D.map(t => {\n return { vals:
backend.readSync(t.dataId), shape: t.shape };
\n });
\n // Concat 2d tensors along axis=1.
\n outShape =
backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);
\n const simplyConcat =
inputs2D[0].shape[0] === 1;
\n const outVals = concatImplCPU(\n inputsValShapes, outShape,
inputs[0].dtype,
 simplyConcat) as string[];
\n const finalOutShape =
backend_util.computeOutShape($inputs.map(t => t.shape), axis);
\n out.shape = finalOutShape;
\n const
outData = backend.dataIdMap.get(out.dataId);
\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);
\n inputs2D.forEach(t => backend.disposeData(t.dataId));
\n return out;
\n }
\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));
\n let sumInnerDims =
0;
\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));
 sumInnerDims += innerDim;
 return innerDim;
\n });
\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));
\n const outVals = backend.typedArrayFromHeap(out);
\n for (let b = 0; b <
batchDim; b++) {\n let outOffset = b * sumInnerDims;
 for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];
 const inOffset = b * innerDim;
 const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);
 outVals.set(vals, outOffset);
 outOffset += innerDim;
 }
\n }
\n return
out; }
\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,
 backendName: 'wasm',
 kernelFunc: concat as { } as KernelFunc,
};
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 * limitations under the License.
 */
=====
*
\nimport { backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from
```

```

'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n
'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', //
outputChannels\n 'number', // outId\n]);\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend:
BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
Conv2D does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n *
=====
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //

```

```

outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number',
// fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n);\n}\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n
inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2,\n
xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n
yChannelStride, outId);\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
conv2DBackpropInput as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/**\n *
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```

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```
=====
*^
import {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {cast} from './Cast';
// Must match enum in CropAndResize.cc
enum InterpolationMethod {
 bilinear = 0,
 nearest = 1
}
let wasmCropAndResize: (
 imagesId: number, boxesId: number, boxIndId: number, numBoxes:
 number,
 imagesShape: Uint8Array, cropHeight: number, cropWidth: number,
 method: number,
 extrapolationValue: number, outId: number) => void;
function setup(backend: BackendWasm): void {
 wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [
 'number', // imagesId
 'number', // boxesId
 'number', // boxIndId
 'number', // numBoxes
 'array', // images shape
 'number', // cropHeight
 'number', // cropWidth
 'number', // method
 'number', // extrapolation value
 'number' // out id
]);
 function cropAndResize(args: {
 backend: BackendWasm,
 inputs: CropAndResizeInputs,
 attrs: CropAndResizeAttrs
 }): TensorInfo {
 const {backend, inputs, attrs} = args;
 const {method, extrapolationValue, cropSize} = attrs;
 const {image, boxes, boxInd} = inputs;
 const numBoxes = boxes.shape[0];
 const [cropHeight, cropWidth] = cropSize as [number, number];
 const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];
 let imagesData = backend.dataIdMap.get(image.dataId);
 let castedData;
 if (image.dtype !== 'float32') {
 castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});
 imagesData = backend.dataIdMap.get(castedData.dataId);
 }
 const imagesId = imagesData.id;
 const boxesId = backend.dataIdMap.get(boxes.dataId).id;
 const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;
 const out = backend.makeOutput(outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);
 wasmCropAndResize(
 imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,
 cropWidth,
 InterpolationMethod[method as {} as keyof typeof InterpolationMethod],
 extrapolationValue, outId);
 if (castedData != null) {
 backend.disposeData(castedData.dataId);
 }
 return out;
 }
 export const cropAndResizeConfig: KernelConfig = {
 kernelName: CropAndResize,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: cropAndResize as {} as KernelFunc
 };
 /**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
}
```

```
=====
*^
import {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {CppType} from './types';
import {transpose} from './Transpose';
let wasmCumsum: (xId: number, exclusive: number, reverse:
number,
 finalDim: number, outId: number, dtype: CCppType) => void;
function setup(backend: BackendWasm) {
 wasmCumsum = backend.wasm.cwrap(Cumsum, null /*void*/, [
 'number', // x_id
 'number', // exclusive
 'number', // reverse
 'number', // final_dim
 'number', // out_id
 'number' // dtype
]);
 export function cumsum(
 args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs}):
 TensorInfo {
 const {inputs, backend, attrs} = args;
 const {x} = inputs;
 const {axis, exclusive, reverse} = attrs;
 const xRank = x.shape.length;
 util.assert(x.dtype === 'float32' || x.dtype === 'int32',
 () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);
 // permute required axis to inner most axis
 const permutation = backend_util.getAxesPermutation([axis], xRank);
 let permutedX = x;
 }
}
```

```

if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n
const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n
const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs:
DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n *
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```
=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {\n FillAttrs, backend: BackendWasm\n}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n */\n
```







```

({outputChannels});\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n }\n\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,
preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation as {}
as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation}
activation not yet supported for FusedDepthwiseConv2D`\n `in the wasm backend.`);\n }\n\n const xId =

```

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backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n
if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n
biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize,
inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n"/**\n * @license\n
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the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n
'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n"/**\n * @license\n
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```
=====\n*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
 './backend_wasm';\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
 number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n]);\n\n function gatherV2(\n args: {backend: BackendWasm, inputs:
 GatherV2Inputs, attrs: GatherV2Attrs}):
 TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
 indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const
 parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
 TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
 = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
 index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
 backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
 batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
 shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
 indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
 {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
 [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n const xData =
 backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
 backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
 Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
 xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
 shapeInfo.outputShape;\n return out;\n }\n\n export const gatherV2Config: KernelConfig = {\n kernelName:
 GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n };}\n\n\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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=====\n*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }\nfrom './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from\n './types';\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,\n null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //\n out_id\n]);\n}\nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n backend: BackendWasm\n }):\n TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either\n float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape)\n !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,\n outId);\n }\n return out;\n}\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```

```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019
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```
=====\n*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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=====\n*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\n from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmMaxPool: (\n xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =\n backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //\n inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //\n padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //\n dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //\n inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:\n {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =\n args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // TF API\n supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it\n because it uses xnpack which only\n // supports float32.\n // Add the following assert only for the WASM\n backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype\n === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n const\n {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight =\n convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const\n padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =\n convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =\n convInfo.outChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm\n backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],\n filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig:\n KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool\n as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n}\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes,
inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n}\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n}\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n
kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n}\n\nfunction
mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const
{inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /*
beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n

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kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as KernelFunc,\n setupFunc:  
setup\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the  
Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the  
License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed  
on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*

```
=====\n*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
 './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google
 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
 './unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
 `non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
 shape equivalent to\n * `Result`\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
 number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
 pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
 pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
 pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
 the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
 NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
 './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
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=====\n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n}\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[\n
{\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma
} = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const
scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId,
maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using
validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize, 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

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=====\n
*\n\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n
'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n}\n\nfunction
oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs,
backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n
```

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wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig:\nKernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as\n {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:\n BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const\n onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as\n {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport\n {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend:\n BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =\n attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim:\n axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const\n expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs:\n expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t =>\n backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName:\n Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright\n 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType}\n from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:\n number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
```



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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n };n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
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=====\n*\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from './kernel_utils/shared';\n\nexport const range = (\n args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };n\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
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*\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n
createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\n\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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*\n\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {cast} from
'./Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n
numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n\nfunction
resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners,
halfPixelCenters, size} = attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth,
numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n
cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
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(castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const\nresizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: resizeBilinear as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
=====
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\n\n*/\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { identity } from\n './Identity';\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,\n axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n 'number'\n // out_id\n]);\n\n export function reverse(\n args: { inputs: ReverseInputs, backend: BackendWasm, attrs:\n ReverseAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { dims } =\n attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length === 0) {\n return\n identity({ inputs: { x }, backend });\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const axesBytes =\n new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n outId);\n\n const reshaped =\n reshape({ inputs: { x: out }, attrs: { shape: x.shape }, backend);\n\n backend.disposeData(out.dataId);\n return reshaped;\n }\n\n export const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as { } as KernelFunc,\n setupFunc:\n setup\n }; \n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
=====
```

```
\n\n*/\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport\n { BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:\n number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //\n batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', //\n radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(\n args: { inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } =\n args;\n const { image } = inputs;\n const { radians, fillValue, center } =\n attrs;\n\n const out =\n backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] =\n image.shape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight,
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imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n\n const fillValues =
typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n
wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n centerY,
fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const rotateWithOffsetConfig: KernelConfig = {\n
kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n
setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from
'/types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
'number' // outId\n]);\n\nfunction scatterNd(\n args:\n {backend: BackendWasm, inputs:
ScatterNdInputs, attrs: ScatterNdAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices,
updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if
(util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides,
outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,

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stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as { } as\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

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=====\n*\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\nimport\n{ BackendWasm } from '../backend_wasm';\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number,\n offset: number,\n outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmSelect =\n backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n}\nfunction select(args: { inputs: SelectInputs, backend:\n BackendWasm }) {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n const conditionId =\n backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =\n backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const cRank = condition.shape.length;\n const tRank =\n t.shape.length;\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 : 0;\n util.sizeFromShape(t.shape.slice(1));\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport\nconst selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { }\n as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-\n core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmFunc: (xId: number, outId: number) =>\n void;\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap('Sigmoid', null /*\n void */,\n ['number', 'number']);\n}\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out\n = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n // Short-\n circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n wasmFunc(xId,\n outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n *
```

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
 number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\n function softmax(\n args: { backend: BackendWasm,
 inputs: SoftmaxInputs, attrs: SoftmaxAttrs }): TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =
 args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
 logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
 (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
 out;\n }\n\n export const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n };
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
 SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from
 '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { padV2Config } from
 './PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nfunction
 spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
 SpaceToBatchNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockSize,
 paddings } = attrs;\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number,
 number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 +
 blockSize.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX =
 padV2Config.kernelFunc({\n inputs: { x },\n backend,\n attrs: { paddings: completePaddings, constantValue:
 0\n }) as TensorInfo;\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape,
 blockSize, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockSize.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockSize, prod, false);\n const reshapeInputs:
 ReshapeInputs = { x: paddedX };\n const reshapeAttrs: ReshapeAttrs = { shape: reshapedPaddedShape };\n const
 paddedXReshaped =\n reshape({ inputs: reshapeInputs, backend, attrs: reshapeAttrs });\n const transposeInputs:
 TransposeInputs = { x: paddedXReshaped };\n const transposeAttrs:\n TransposeAttrs = { perm:
 permutedReshapedPaddedPermutation };\n const paddedXT =\n transpose({ inputs: transposeInputs, backend,
 attrs: transposeAttrs });\n const resultReshapeInputs: ReshapeInputs = { x: paddedXT };\n const
 resultReshapeAttrs: ReshapeAttrs = { shape: flattenShape };\n const result = reshape(\n { inputs:
 resultReshapeInputs, backend, attrs: resultReshapeAttrs });\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n return
```

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result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { slice } from './Slice';\n\nexport function splitV(\n args: { inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm }) {\n const { inputs, attrs, backend } = args;\n const { x } = inputs;\n const { numOrSizeSplits, axis } = attrs;\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({ inputs: { x }, attrs: { begin, size: xSliceSize }, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n\n*/\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n *
```

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmStep:\n(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\nBackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {\n backend:\nBackendWasm, inputs: StepInputs, attrs: StepAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { alpha } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\nbackend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId,\nalpha, CppDType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName:\nStep,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n\n"/**\n *\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,\nutil } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:\nUint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', //\noutShapeLength\n 'number', // outId\n]);\n}\n\nexport function stridedSlice(args: {\n backend: BackendWasm,\ninputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { x } = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\nslice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({ inputs: { x },\nbackend, attrs: { shape: finalShape } });\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is\nmemory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have\nrank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({ inputs: { x },\nbackend, attrs: { begin: $begin, size } });\n result =\n reshape({ inputs: { x: sliced }, backend, attrs: { shape:\nfinalShape } });\n backend.disposeData(sliced.dataId);\n } else {\n const out =\nbackend.makeOutput(finalShapeSparse, 'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const\nxStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes\n= new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new\nInt32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const\n\n=====\n
```

```

outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n", "/**\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend:
BackendWasm, inputs: SumInputs, attrs: SumAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
 const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 let\n inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
 permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,\n input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,\n input.shape.length);\n const [outShape, reduceShape] =\n
 backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n", "/**\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:\n number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //\n x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CCppType[out.dtype], outId);\n return\n out;\n}\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n};\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmTopK:
```



kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as  
KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the  
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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {slice} from
 './Slice';\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n }\n\nexport const
unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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```
=====\n*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

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=====\n*\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
'./kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
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{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
 './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n
 argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n
 clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n

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cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n
depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n
flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n
fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n
greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n
logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n
minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {env} from 'tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n/**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)

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})return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer
)})return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module[\'"ready"\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\'"ENVIRONMENT_IS_PTHREAD"\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\'"buffer"\"]}var scriptDirectory="";function
locateFile(path){if(Module[\'"locateFile"\"]){return Module[\'"locateFile"\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=no
dePath[\'"normalize"\"](filename);return
nodeFS[\'"readFileSync"\"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\'"argv"\"].length>1){thisProgram=process[\'"argv"\"][1].replace(/\\/g,"^")}arguments_=process[\'"arg
v"\"].slice(2);process[\'"on"\"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\'"on"\"]("unhandledRejection",abort);quit_=function(status){process[\'"exit"\"](status)};Module[\'"insep
ect"\"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
"worker_threads" module is not supported in this node.js build - perhaps a newer version is needed?);throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir != "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("^")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction

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shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs\");if(!nodePath)nodePath=require("\path\");filename=normalizePath(normalize\)(filename);return
nodeFS[\readFileSync\](filename,binary?null:\utf8\);readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("\perf_hooks\").performance}}var
out=Module[\print\]||console.log.bind(console);var err=Module[\printErr\]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\])arguments_=Module[\arguments\];if(Module[\thisProgram\])thisProgram=
Module[\thisProgram\];if(Module[\quit\])quit_=Module[\quit\];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\wasmBinary\])wasmBinary=Module[\wasmBinary\];var
noExitRuntime=Module[\noExitRuntime\]||true;if(typeof WebAssembly!=="object"){abort(\no native wasm
support detected)}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module[_"+ident];assert(func,\Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={\string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var

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endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&&63;heap[
outIdx++]=128|u>>6&&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread

```



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worker`);runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](run
Dependencies)}}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\\\"Pthread aborting at \\\"+(new
Error).stack);what+=\\\"\\\";err(what);ABORT=true;EXITSTATUS=1;what=\\\"abort(\\\"+what+\\\"). Build with -s
ASSERTIONS=1 for more info.\\\";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\\\"data:application/octet-stream;base64,\\\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\\\"file://\\\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\\\"tfjs-backend-wasm-threaded-
simd.wasm\\\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\\\"both async and sync fetching of the
wasm failed\\\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\\\"function\\\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\\\"same-
origin\\\"}).then(function(response){if(!response[\\\"ok\\\"]){throw\\\"failed to load wasm binary file at
\\\"+wasmBinaryFile+\\\"\\\"}return response[\\\"arrayBuffer\\\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\\\"a\\\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\\\"asm\\\"]=exports;wasmTable=Module[\\\"asm\\\"][\\\"I\\\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if!--numWorkersToLoad)removeRunDependency(\\\"wasm-
instantiate\\\")}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\\\"wasm-instantiate\\\")}function
receiveInstantiatedSource(output){receiveInstance(output[\\\"instance\\\"],output[\\\"module\\\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\\\"failed to asynchronously prepare
wasm: \\\"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\\\"function\\\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\\\"function\\\"){return fetch(wasmBinaryFile,{credentials:\\\"same-
origin\\\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\\\"wasm streaming compile failed: \\\"+reason);err(\\\"falling
back to ArrayBuffer instantiation\\\")});return instantiateArrayBuffer(receiveInstantiatedSource)})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\\\"instantiateWasm\\\"]){try{var
exports=Module[\\\"instantiateWasm\\\"](info,receiveInstance);return exports}catch(e){err(\\\"Module.instantiateWasm
callback failed with error: \\\"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\\\"Canceled!\\\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}});function initPthreadsJS(){PThread.initRuntime()}function

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callRuntimeCallbacks(callbacks){ while(callbacks.length>0){ var callback=callbacks.shift();if(typeof
callback=="function"){ callback(Module);continue }var func=callback.func;if(typeof
func=="number"){ if(callback.arg===undefined){ wasmTable.get(func)() }else { wasmTable.get(func)(callback.arg)
} }else { func(callback.arg===undefined?null:callback.arg) } } }var
ERRNO_CODES={ EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,EB
ADFD:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5 };function
_emsripten_futex_wake(addr,count){ if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){ var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){ --count;mainThreadWoken=1;if(count<=0)return
1 } }var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomics.notify returned an unexpected value
"+ret}Module["_emsripten_futex_wake"]=_emsripten_futex_wake;function
killThread(pthread_ptr){ if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){ if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){ if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){ GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker) } }var
PThread={ unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){ var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){ PThread.allocateUnusedWorker() },initRuntime:function(){ var
tb=_malloc(228);for(var

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i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb),initWorker:function(){},pthreads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit\"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone\"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d["thread"])}else
if(cmd===\"killThread\"){killThread(d["thread"])}else
if(cmd===\"cancelThread\"){cancelThread(d["thread"])}else
if(cmd===\"loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\"print\"){out(\"Thread \"+d["threadId"]+\"\":
\"+d["text"])}else if(cmd===\"printErr\"){err(\"Thread \"+d["threadId"]+\"\": \"+d["text"])}else
if(cmd===\"alert\"){alert(\"Thread \"+d["threadId"]+\"\": \"+d["text"])}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if

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(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\exitProcess\){try{exit(d[\returnCode\])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\cancelDone\){PThread.returnWorkerToPool(worker)}else
if(cmd===\objectTransfer\){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\setimmediate\){worker.postMessage(e.data)}else{err(\worker sent an unknown command
\'+cmd\)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\pthread sent
an error! \'+e.filename+\':\'+e.lineno+\':
\'+e.message\)};if(ENVIRONMENT_IS_NODE){worker.on(\message\,function(data){worker.onmessage({data:d
ata})});worker.on(\error\,function(data){worker.onerror(data)});worker.on(\exit\,function(data){})}worker.post
Message({\cmd\:\load\,\urlOrBlob\:\Module[\mainScriptUrlOrBlob\]\|_scriptId\,\wasmMemory\:\wasmMe
memory\,\wasmModule\:\wasmModule\)},allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\tfjs-
backend-wasm-threaded-simd.worker.js\);PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\establishStackSpace\]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\getNoExitRuntime\]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\Assertion failed: \'+UTF8ToString(condition)+\', at:
\'+[filename?UTF8ToString(filename):\unknown filename\],line,func?UTF8ToString(func):\unknown
function\')}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\hrtime\]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[__performance_now_clock_drift\]}}else if(typeof
dateNow!=="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\cmd\:\processQueuedMainThreadWork\})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\targetThread\:\targetThreadId,\cmd\:\processThreadQueue
e\})}else{var pthread=PThread.threads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\cmd\:\processThreadQueue\})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\timed-out\)return-
73;if(ret===\not-equal\)return-6;if(ret===\ok\)return 0;throw\Atomics.wait returned an unexpected value
\'+ret\}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-

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73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("\os").cpus().length;return
navigator["hardwareConcurrency"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListene
rs:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var

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call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeId||event
TypeString==JSEvents.eventHandlers[i].eventTypeId)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeId,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackFunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeId,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeId==eventHandler.eventTypeId){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height;if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var

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autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height } canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height) } else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1 } else{ return-4 } return 0 } function
_emscripten_set_canvas_element_size_main_thread(target,width,height){ if(ENVIRONMENT_IS_PTHREAD)retur
n _emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height) } function
_emscripten_set_canvas_element_size(target,width,height){ var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emscripten_set_canvas_element_size_calling_thread(target,width,height) } else{ return
_emscripten_set_canvas_element_size_main_thread(target,width,height) } } function
_emscripten_set_current_thread_status(newStatus){ } function
_emscripten_set_thread_name(threadId,name){ } function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ ctx["vertexAttribDivisor"]=function(index,divisor){ ex
t["vertexAttribDivisorANGLE"](index,divisor);ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ ext["drawArraysInstancedANGLE"](mode,first,count,primcount);ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount);
return 1 } } function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao);
ctx["bindVertexArray"]=function(vao){ ext["bindVertexArrayOES"](vao);ctx["isVertexArray"]=function(vao)
{ return ext["isVertexArrayOES"](vao);return 1 } } function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ ctx["drawBuffers"]=function(n,bufs){ ext["drawBuffers
WEBGL"](n,bufs);return 1 } } function
__webgl_enable_WEBGL_multi_draw(ctx){ return!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w")) } var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null } return
ret },getSource:function(shader,count,string,length){ var source="";for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len) } return
source },createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle },registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context) } return
handle },makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx) },getContext:function(c
ontextHandle){ return

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GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+\"\\\"+j+\"\\\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=[\"default\", \"low-power\", \"high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var

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routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
__pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg)}})f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! spawnThread()
can only ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`"Internal
error!`;if(!threadParams.pthread_ptr)throw`"Internal error, no pthread
ptr!`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={`"cmd\":"run\","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthr
ead=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){ worker.runPthread();delete worker.runPthread}}function
__pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`"undefined`"){err(`"Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`"pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
__emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){ stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{ stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={ stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){ threadParams.cmd=`"spawnThread"`;postMessage(threadParams,transferList)}else{ spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw`"Canceled!`"}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(`"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread")}function

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__emscripten_do_pthread_join(thread,status,block){if(!thread){err("\pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err("\PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err("\Main thread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("\pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("\Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":\"cleanupThread\", \"thread\":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function _pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscrip
ten_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var

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_init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"][_"C"]).apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Module["asm"][_"D"]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["asm"][_"E"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["asm"][_"F"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["asm"][_"G"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["asm"][_"H"]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["asm"][_"J"]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["asm"][_"K"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["asm"][_"L"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["asm"][_"M"]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["asm"][_"N"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["asm"][_"O"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["asm"][_"P"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["asm"][_"Q"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["asm"][_"R"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["asm"][_"S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["asm"][_"T"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["asm"][_"U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["asm"][_"V"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["asm"][_"W"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["asm"][_"X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["asm"][_"Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["asm"][_"_"]).apply(null,arguments)};var

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_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)}
;var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa"]]).apply(null,arguments)};var

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_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["x
a")]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya")]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za")]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][["Aa")]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][["Ba")]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][["Ca")]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da"
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea")]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa")]).apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga")]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha")]).apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia")]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja")]).app
ly(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka")]).apply(null,argum
ents)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La")]).apply(null,a
rguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][["Ma")]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na")]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][["Oa")]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa")]).apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa")]).apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra
")]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa")]).
apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta")]).ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua")]).apply(null,arguments
)};var

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_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Xa"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["_a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]["kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"]["lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"]["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"]["ob"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"]["pb"]).apply(null,arguments)};var

```

```

__emscripten_register_main_browser_thread_id=Module["__emscripten_register_main_browser_thread_id"]=function()
{return(__emscripten_register_main_browser_thread_id=Module["__emscripten_register_main_browser_thread_id"]=Module["asm"]
["qb"]).apply(null,arguments)};var
__emscripten_main_browser_thread_id=Module["__emscripten_main_browser_thread_id"]=function()
{return(__emscripten_main_browser_thread_id=Module["__emscripten_main_browser_thread_id"]=Module["asm"]
["rb"]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function()
{return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"]
["sb"]).apply(null,arguments)};var
__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=function()
{return(__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=Module["asm"]
["tb"]).apply(null,arguments)};var
__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=function()
{return(__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=Module["asm"]
["ub"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function()
{return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"]
["vb"]).apply(null,arguments)};var
__emscripten_tls_init=Module["__emscripten_tls_init"]=function()
{return(__emscripten_tls_init=Module["__emscripten_tls_init"]=Module["asm"]
["wb"]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function()
{return(__emscripten_thread_init=Module["__emscripten_thread_init"]=Module["asm"]
["xb"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function()
{return(stackSave=Module["stackSave"]=Module["asm"]
["yb"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function()
{return(stackRestore=Module["stackRestore"]=Module["asm"]
["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function()
{return(stackAlloc=Module["stackAlloc"]=Module["asm"]
["Ab"]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module["__emscripten_stack_set_limits"]=function()
{return(__emscripten_stack_set_limits=Module["__emscripten_stack_set_limits"]=Module["asm"]
["Bb"]).apply(null,arguments)};var
__memalign=Module["__memalign"]=function()
{return(__memalign=Module["__memalign"]=Module["asm"]
["Cb"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=10512;var
__emscripten_main_thread_futex=Module["__emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module["ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromiseResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun()}if(Module["setStatus"]){Module["setStatus"]("Running..");setTimeout(function(){setTimeout(function(){Module["setStatus"]("");},1);doRun()},1)}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PTHREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw new

```





```

WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\"./this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=
nodePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\");arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"}}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\")read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\")return new
Uint8Array(readbuffer(f))data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\")arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\")arguments_=arguments;if(typeof
quit===\"function\")quit_=function(status){quit(status)}if(typeof print!=\"undefined\")if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src;if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror()};xhr.onerror=onerror;xhr.send(null)}

```

```

}setWindowTitle=function(title){ document.title=title }else{ }var
out=Module[\'"print"\"]||console.log.bind(console);var err=Module[\'"printErr"\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\'"arguments"\"])arguments_=Module[\'"arguments"\"];if(Module[\'"thisProgram"\"])thisProgram=
Module[\'"thisProgram"\"];if(Module[\'"quit"\"])quit_=Module[\'"quit"\"];var
wasmBinary;if(Module[\'"wasmBinary"\"])wasmBinary=Module[\'"wasmBinary"\"];var
noExitRuntime=Module[\'"noExitRuntime"\"]||true;if(typeof WebAssembly!=="object"){ abort(\'"no native wasm
support detected"\')}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){ abort(\'"Assertion failed: '+text"\')} }function getCFunc(ident){ var
func=Module[\'"_'"+ident\"];assert(func,\'"Cannot call unknown function '+ident+"", make sure it is exported\");return
func }function ccall(ident,returnType,argTypes,args,opts){ var toC={\'"string"\":function(str){ var
ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\'"array"\":function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret }};function
convertReturnValue(ret){ if(returnType===\'"string"\")return UTF8ToString(ret);if(returnType===\'"boolean"\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){ for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){ if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{ cArgs[i
]=args[i] }} }var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type===\'"number"\'});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){ return getCFunc(ident)}return
function(){ return ccall(ident,returnType,argTypes,arguments,opts) }}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder(\'"utf8"\"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){ return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str=\'";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){ str+=String.fromCharCode(u0);continue }var
u1=heap[idx++]&63;if((u0&224)==192){ str+=String.fromCharCode((u0&31)<<6|u1);continue }var
u2=heap[idx++]&63;if((u0&240)==224){ u0=(u0&15)<<12|u1<<6|u2}else{ u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63 }if(u0<65536){ str+=String.fromCharCode(u0)}else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) }} }return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\'"\' }function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{ if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 }} heap[outIdx]=0;return outIdx-startIdx }function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){ HEAP8.set(array,buffer)}function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple}return x }var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function

```

```

updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort("+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^/";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+"wasmBinaryFile+"})return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function

```

```

receiveInstantiatedSource(output){receiveInstance(output["instance\"])function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iovcnt,pnum){var num=0;for(var
i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return

```

```

16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84: {if(typeof
navigator===\object")return navigator[\hardwareConcurrency\]|1;return 1 } setErrNo(28);return-1 } var
asmLibraryArg={\a\:_abort,\d\:_emscripten_memcpy_big,\e\:_emscripten_resize_heap,\f\:_fd_close,\c\:_f
d_seek,\b\:_fd_write,\h\:_pthread_create,\g\:_pthread_join,\i\:_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[__wasm_call_ctors\]=function(){return(__wasm_call_ctors=Module[__wasm
_call_ctors\]=Module[\asm\][\k\]).apply(null,arguments)};var
_init=Module[_init\]=function(){return(_init=Module[_init\]=Module[\asm\][\l\]).apply(null,arguments)};
var
_init_with_threads_count=Module[_init_with_threads_count\]=function(){return(_init_with_threads_count=Mod
ule[_init_with_threads_count\]=Module[\asm\][\m\]).apply(null,arguments)};var
_get_threads_count=Module[_get_threads_count\]=function(){return(_get_threads_count=Module[_get_threads
_count\]=Module[\asm\][\n\]).apply(null,arguments)};var
_register_tensor=Module[_register_tensor\]=function(){return(_register_tensor=Module[_register_tensor\]=M
odule[\asm\][\o\]).apply(null,arguments)};var
_dispose_data=Module[_dispose_data\]=function(){return(_dispose_data=Module[_dispose_data\]=Module[\
asm\][\p\]).apply(null,arguments)};var
_dispose=Module[_dispose\]=function(){return(_dispose=Module[_dispose\]=Module[\asm\][\q\]).apply(n
ull,arguments)};var
_Abs=Module[_Abs\]=function(){return(_Abs=Module[_Abs\]=Module[\asm\][\s\]).apply(null,arguments
)};var
_Add=Module[_Add\]=function(){return(_Add=Module[_Add\]=Module[\asm\][\t\]).apply(null,argument
s)};var
_AddN=Module[_AddN\]=function(){return(_AddN=Module[_AddN\]=Module[\asm\][\u\]).apply(null,ar
guments)};var
_All=Module[_All\]=function(){return(_All=Module[_All\]=Module[\asm\][\v\]).apply(null,arguments)};
var
_Any=Module[_Any\]=function(){return(_Any=Module[_Any\]=Module[\asm\][\w\]).apply(null,argumen
ts)};var
_ArgMax=Module[_ArgMax\]=function(){return(_ArgMax=Module[_ArgMax\]=Module[\asm\][\x\]).app
ly(null,arguments)};var
_AvgPool=Module[_AvgPool\]=function(){return(_AvgPool=Module[_AvgPool\]=Module[\asm\][\y\]).a
pply(null,arguments)};var
_BatchMatMul=Module[_BatchMatMul\]=function(){return(_BatchMatMul=Module[_BatchMatMul\]=Modu
le[\asm\][\z\]).apply(null,arguments)};var
_Ceil=Module[_Ceil\]=function(){return(_Ceil=Module[_Ceil\]=Module[\asm\][\A\]).apply(null,argument
s)};var
_ClipByValue=Module[_ClipByValue\]=function(){return(_ClipByValue=Module[_ClipByValue\]=Module[\
asm\][\B\]).apply(null,arguments)};var
_Conv2D=Module[_Conv2D\]=function(){return(_Conv2D=Module[_Conv2D\]=Module[\asm\][\C\]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module[_Conv2DBackpropInput\]=function(){return(_Conv2DBackpropInput=Modul
e[_Conv2DBackpropInput\]=Module[\asm\][\D\]).apply(null,arguments)};var
_Cos=Module[_Cos\]=function(){return(_Cos=Module[_Cos\]=Module[\asm\][\E\]).apply(null,arguments
)};var
_Cosh=Module[_Cosh\]=function(){return(_Cosh=Module[_Cosh\]=Module[\asm\][\F\]).apply(null,argu
ments)};var
_CropAndResize=Module[_CropAndResize\]=function(){return(_CropAndResize=Module[_CropAndResize\])

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=Module["asm"]["G"].apply(null,arguments));var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).a
pply(null,arguments));var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"]["I"]).apply(null,arguments));var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=M
odule["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments));var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)
};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arg
uments));var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,argument
s));var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Modul
e["asm"]["N"]).apply(null,arguments));var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,argu
ments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).
apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchN
orm"]=Module["asm"]["Q"]).apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Modu
le["asm"]["R"]).apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=M
odule["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null
,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"
]).apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(
null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[
"asm"]["W"]).apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"]["
X"]).apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"]["Y"]).apply(null,argume
nts));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"]["
Z"]).apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"]["_"]).apply(null,arguments
)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"]["$"]).apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"]["aa"]).apply(null,argume
nts));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"]["ba"]).
apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"]["c

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a").apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var

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\").apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Ba"]).
.apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ca"]).ap
ply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Da"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Ea"]).ap
ply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Fa"]).apply(null,argumen
ts));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Ga"]).apply(n
ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"]["Ha"]).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Ia"]).apply(null,argume
nts));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"]["Ja"]).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"]).apply(null,argument
s));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"]).apply(null,argumen
ts));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"]).apply(null,argumen
ts));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"]).apply(null,argu
ments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,argumen
ts));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["Pa"]).apply(null,ar
guments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["Qa"
]).apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["Ra"
]).apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"]["Sa"]).apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["Ta"]).apply(nu
ll,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["Ua"]).apply(null,argument
s));var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"]["Va"]).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["Wa"
]).apply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
]["Xa"]).apply(null,arguments));var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"

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this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n}\n\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n}\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n}\n\n floatPrecision():\n 32 {\n return 32;\n}\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n}\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n}\n\n memory() {\n return {unreliable:\n false};\n}\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:\n number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset\n == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =\n this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n}\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const\n {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new\n Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,\n size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\n\nfunction\n createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n };\n}\n\n /**\n * Returns the path of the WASM binary.\n */\n * @param\n simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return\n wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&\n threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =\n 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return\n wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n}\n\n /**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n */\n * NOTE: We wrap the wasm module in a object with property\n 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in\n Chrome 76).\n */\n * ^nextport async function init(): Promise<{wasm: BackendWasmModule}> {\n const\n [simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
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env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n *^\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n };\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n };\n return prefix
+ path;\n };\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n };\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the '+\n 'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has
been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath ==
null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [\n var WasmBackendModuleThreadedSimd = `
+\n wasmFactoryThreadedSimd.toString(),\n]\n);\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
was.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
[number]),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
[number]),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };\n\n resolve({ wasm: module });\n
});\n });\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n
throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-
wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const ;\n\ntype
WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:
string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet
customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n *^\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*^\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and'+\n ' ' will be removed in a future release.);\n
if (initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call '+\n

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`setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`;\n }
\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * `js`\n * setWasmPaths({\n * 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n * 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
``\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n *
full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located
in the same directory, or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional
boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n * @doc {heading:
'Environment', namespace: 'wasm'}\n *\nexport function setWasmPaths(\n prefixOrFileMap: string|{\n * [key in
WasmBinaryName]?: string,\n * usePlatformFetch = false): void {\n * if (initAborted) {\n * throw new Error(\n
'The WASM backend was already initialized. Make sure you call '\n * `setWasmPaths()` before you call
`tf.setBackend()` or '\n * `tf.ready()`);\n * }\n * if (typeof prefixOrFileMap === 'string') {\n * wasmPathPrefix
= prefixOrFileMap;\n * } else {\n * wasmFileMap = prefixOrFileMap;\n * const missingPaths =\n *
wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n * if (missingPaths.length > 0) {\n * throw new
Error(\n * `There were no entries found for the following binaries: ` +\n * `${missingPaths.join(',')}. Please
either call setWasmPaths with a ` +\n * `map providing a path for each binary, or with a string indicating ` +\n
* `the directory where all the binaries can be found.`);\n * }\n * }\n * }\n * customFetch = usePlatformFetch;\n * }\n\n/**
Used in unit tests.\n *\nexport function resetWasmPath(): void {\n * wasmPath = null;\n * wasmPathPrefix = null;\n *
wasmFileMap = {};\n * customFetch = false;\n * initAborted = false;\n * }\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n *\n * This must be called before calling
`tf.setBackend('wasm')`.\n *\nexport function setThreadsCount(numThreads: number) {\n * threadsCount =
numThreads;\n * }\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n *\n * It is set after the
backend is initialized.\n *\nexport function getThreadsCount(): number {\n * if (actualThreadsCount === -1) {\n *
throw new Error(`WASM backend not initialized.`);\n * }\n * return actualThreadsCount;\n * }\n\n"/** @license See the
LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\n\nconst version = '3.11.0';\nexport
{version};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n * const {wasm} = await init();\n * return new
BackendWasm(wasm);\n * },
WASM_PRIORITY);\n\n], "names":["_FusedMatMul","util","Abs","backend_util","Add","AddN","Identity","setup",
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mplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2
DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","s
upportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm",
"FusedConv2D","FusedDepthwiseConv2D","GatherNd","GatherV2","Greater","GreaterEqual","setupFunc","Leaky
Relu","Less","LessEqual","Log","LogicalAnd","Max","Maximum","MaxPool","Mean","Min","Minimum","Mirror

```

Pad", "Multiply", "Neg", "NonMaxSuppressionV3", "NonMaxSuppressionV4", "NonMaxSuppressionV5", "kernelFunc", "NotEqual", "OneHot", "OnesLike", "Pack", "PadV2", "Pow", "Prelu", "Prod", "rangeImplCPU", "Range", "RealDiv", "Relu", "Relu6", "ResizeBilinear", "Reverse", "RotateWithOffset", "Round", "Rsqrt", "ScatterNd", "Select", "Sigmoid", "Sin", "Softmax", "SpaceToBatchND", "SplitV", "Sqrt", "Square", "SquaredDifference", "Step", "StridedSlice", "Sub", "Sum", "Tan", "Tanh", "Tile", "TopK", "Transform", "Unpack", "ZerosLike", "registerKernel", "env", "require\$\$0", "require\$\$1", "require\$\$2", "global", "require\$\$3", "require\$\$4", "tslib\_1.\_\_extends", "DataStorage", "engine", "KernelBackend", "wasmFactoryThreadedSimd", "wasmFactory", "deprecationWarn", "registerBackend"], "mappings": ";;;;;;;;;;;;;EAAA;;;;;;;;;;;;;EAIbA;EACA,IAAY,QAMX;EAND,WAAY,QAAQ;MACIB,6CAAW,CAAA;MACX,yCAAS,CAAA;MACT,uCAAQ,CAAA;MACR,2CAAU,CAAA;MACV,iDAAa,CAAA;EACf,CAAC,EANW,QAAQ,KAA R,QAAQ,QAMnB;EAED;EACA,IAAY,iBAQX;EARD,WAAY,iBAAiB;MAC3B,6DAAU,CAAA;MACV,yDAA Q,CAAA;MACR,2DAAS,CAAA;MACT,2DAAS,CAAA;MACT,mEAAa,CAAA;MACb,+DAAW,CAAA;MACX, uDAAO,CAAA;EACT,CAAC,EARW,iBAAiB,KAAjB,iBAAiB;;EC3B7B;;;;;;;;;;;;;EAuBA,IAAI,eAKQ,CAAC; EAEB,SAAS,KAAK,CAAC,OAAoB;MACjC,eAAe,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACA,qBAAY, EAAE,IAAI,aAAa;UACIE,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;UACR,OAAO;UACP,QAAQ;UA CR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CA AC,CAAC;EACL,CAAC;EAED,SAAS,gBAAGB,CAAC,IAIzB;MACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kB AAK,CAAS;MAC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAAI,EAAE,sDAAsB,CAAW;MAEpD,IAAI,CAAC,C AAC,KAAK,KAAK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,EAAE;UACID,MAAM,IAAI,KAAK,CAC X,6DAA6D,CAAC,CAAC;OACpE;MAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAAU; MACnE,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC, EAAE,CAAC;MAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM, CAAC,CAAC,EAAE,CAAC;MAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;MACf,IAAI,IAAI,IAAI,IAAI,EAAE;U AChB,IAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;UA CpD,IAAI,QAAQ,CAAC,KAAK,CAAC,MAAM,KAAK,CAAC,EAAE;cAC/B,MAAM,IAAI,KAAK,CACX,iDA AiD;mBACjD,UAAQ,QAAQ,CAAC,KAAK,CAAC,MAAM,MAAG,CAAA,CAAC,CAAC;WACvC;UACD,MAA M,GAAG,QAAQ,CAAC,EAAE,CAAC;OActB;MACD,IAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;UAC3D,C AAC;UACD,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC; MAC5D,IAAM,eAAe,GACjB,iBAAiB,CAAC,UAAkD,CAAC,CAAC;MACIE,IAAI,eAAe,IAAI,IAAI,EAAE;UA C3B,MAAM,IAAI,KAAK,CACR,UAAU,mDAAgD;cAC7D,sBAAsB,CAAC,CAAC;OAC7B;MAED,IAAM,OAA O,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAA C,CAAC,CAAC;MACrD,IAAM,QAAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAA G,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC;MACtD,IAAM,QAAQ,GAAG,CAAC,CAAC,KAAK,CAA C,CAAC,CAAC,CAAC;MAE5B,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,QAAQ,EAAE,OAA O,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACvE,IAAM,KAAK,GAAG,OAAO,CAA C,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD,IAAM,WAAW,GA AG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;MACn E,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM, CAAC,CAAC;MAEnE,eAAe,CACX,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE, GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,UAAU,EAAE,UAAU,EAAE,eAAe,E AAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;MAEHc,OAAO,GAAG, CAAC;EACb,CAAC;EAEM,IAAM,iBAAiB,GAaiB;MAC7C,UAAU,EAAEA,qBAAY;MACxB,WAAW,EAAE, MAAM;MACnB,SAAS,EAAE,KAAK;MACHb,UAAU,EAAE,gBAAoC;GACjD;;EC7GD;;;;;;;;;;;;;WauBgB,uB AAuB,CACnC,UAAkB,EAAE,OAAkB;MACxC,IAAI,QAA6D,CAAC;MAEIE,SAAS,SAAS,CAAC,OAAoB;UA CrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;cACzD,QAAQ;cACR, QAAQ;cACR,QAAQ;WACT,CAAC,CAAC;OACJ;MAED,SAAS,UAAU,CAAC,IAAiD;UAE5D,IAAA,sBAAO,E AAW,iBAAC,CAAU;UACpC,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC, MAAM,CAAC,CAAC,EAAE,CAAC;UAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC, KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC;UAC5D,IAAM,KAAK,GAAG,OAAO,CAAC,S

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,CAAC;WAEe,gBAAgB,CAAC,IAIhC;MACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;MAC/B,IA  
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D,SAAS,EAAE7E,OAAK;GACjB;;EChFD;,,,,,,,,,,,,,;EAoBO,IAAM,WAAW,GAAiB,uBAAuB,CAAC8E,cAAK,  
CAAC;;ECpBvE;,,,,,,,,,,,,,;EAmBO,IAAM,WAAW,GAAiB,uBAAuB,CAACC,cAAK,CAAC;;ECnBvE;,,,,,,,,,,,,,;  
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C;EAED,SAAS,SAAS,CACd,IAC0E;MAErE,IAAA,sBAAO,EAAE,oBAAM,EAAE,kBAAK,CAAS;MAC/B,IAA  
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Found in path(s):

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

```
{ "version": 3, "file": "StridedSlice.js", "sourceRoot": "", "sources": ["../src/kernels/StridedSlice.ts"], "names": [], "mappings": "AAAA;;;;;;;GAeG;AAEH,OAAO,EAA2B,UAAU,EAAE,YAAY,EAAqD,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAGIJ,OAAO,EAAC,OAAO,EAAC,MAAM,WAAW,CAAC;AACIC,OAAO,EAAC,KAAK,EAAC,MAAM,SAAS,CAAC;AAE9B,IAAI,gBAI8C,CAAC;AAEnD,SAAS,KAAK,CAAC,OAAoB;IACjC,gBAAGB,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,YAAY,EAAE,IAAI,CAAC,QAAQ,EAAE;QACjE,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,OAAO;QACP,OAAO;QACP,OAAO;QACP,OAAO;QACP,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,MAAM,UAAU,YAAY,CAAC,IAI5B;IACC,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;IACtC,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;IAEnB,MAAM,EACJ,KAAK,EAEL,GAAG,EACH,OAAO,EACP,SAAS,EACT,OAAO,EACP,YAAY,EACZ,WAAW,EACX,cAAc,EACf,GAAG,KAAK,CAAC;IAEV,MAAM,EACJ,gBAAGB,EACHb,UAAU,EACV,UAAU,EACV,SAAS,EACT,aAAa,EACb,KAAK,EAAE,MAAM,EACb,GAAG,EAAE,IAAI,EACT,OAAO,EA AE,QAAQ,EACIB,GACG,UAAU,CAAC,SAAS,CACHb,CAAC,CAAC,KAAK,EAAE,KAAK,EAAE,GAAG,EA AE,OAAO,EAAE,SAAS,EAAE,OAAO,EAAE,YAAY,EAC9D,WAAW,EAAE,cAAc,CAAC,CAAC;IAErC,IAAI,MAAM,CAAC;IAEX,IAAI,UAAU,EAAE;QACd,iDAaiD;QACjD,MAAM,GAAG,OAAO,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,UAAU,EAAC,EAAC,CAAC,CAAC;KACtE;SAAM,IAAI,SAAS,IAAI,aAAa,EAAE;QACrC,qEAAqE;QACrE,IAAI,CAAC,MAAM,CACP,CAAC,CAAC,KAAK,CAAC,MAAM,IAAI,CAAC,EACnB,GAAG,EAAE,CAAC,yCAAYc,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,CAAC,CAAC;QAErE,MAAM,IAAI,GAAG,UAAU,CAAC,eAAe,CAAC,MAAM,EAAE,IAAI,EAAE,QAAQ,CAAC,CAAC;QACHE,wEAAwE;QACxE,MAAM,MAAM,GAAG,KAAK,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,MAAM,EAAE,IAAI,EAAC,EAAC,CAAC,CAAC;QAC3E,MAAM;YACF,OAAO,CAAC,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,MAAM,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,KAAK,EAAE,UAAU,EAAC,EAAC,CAAC,CAAC;QACxE,OAAO,CAAC,WAAW,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC;KACpC;SAAM;QACL,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,gBAAGB,EAAE,SAAS,CAAC,CAAC;QAE5D,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,MAAM,aAAa,GACf,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,IAAI,CAAC,cAAc,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC;QACxE,MAAM,UAAU,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,MAAM,CAAC,CAAC,MAAM,CAAC,CAAC;QACjE,MAAM,QAAQ,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,IAAI,CAAC,CAAC,MAAM,CAAC,CAAC;QAC7D,MAAM,YAAY,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,QAAQ,CAAC,CAAC,MAAM,CAAC,CAAC;QAErE,MAAM,gBAAGB,GACIB,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,gBAAGB,CAAC,CAAC,MAAM,CAAC,CAAC;QAC5D,MAAM,eAAe,GAAG,IAAI,UAAU,CACI
```





Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/StridedSlice.js.map
```

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

```
{ "version":3,"file":"tf-backend-wasm.min.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/All.ts","../src/kernels/kernel_utils.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/ClipByValue.ts","../src/kernels/Ceil.ts","../src/kernels/Concat.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/Max.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/MaxPool.ts","../src/kernels/Maximum.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/MirrorPad.ts","../src/kernels/Minimum.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/OneHot.ts","../src/kernels/NotEqual.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/kernels/Prelu.ts","../src/kernels/Pow.ts","../src/kernels/Prod.ts","../src/kernels/ResizeBilinear.ts","../src/kernels/Range.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/ScatterNd.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Softmax.ts","../src/kernels/Sin.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Step.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sum.ts","../src/kernels/Sub.ts","../src/kernels/Tile.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/register_all_kernels.ts","../src/kernels/ZerosLike.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm.js","../src/backend_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js","../src/base.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * This enum must align with the enum defined in cc/backend.h.\n * export enum CppDType {\n * float32 = 0,\n * int32 = 1,\n * bool = 2,\n * string = 3,\n * complex64 = 4\n * }\n * Must match enum in cc/fusable_activations.h.\n * export
```

enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6}\n\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from\n './types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //\n leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs:\n _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const { inputs, backend,\n attrs } = args;\n const { a, b, bias, preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==\n 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank\n ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId =\n preluActivationWeights == null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const\n fusedActivation =\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if\n (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet supported for\n FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out =\n backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n };\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport\n { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function\n createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
```

```

number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
// Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n
wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',
setupFunc, kernelFunc};\n}\n\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n", /*\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n
TensorInfo {\n const {backend,\n inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =
backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,\n outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return
out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =
new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if
(supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const
aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>
v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet `+\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n", /*\n * @license\n * Copyright 2019 Google

```

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```
=====\n*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmFunc:\n (inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =\n backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n const inputIds = inputs.map(x =>\n backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,\n CCppType[out.dtype], outId);\n return out;\n}\nexport const addNConfig: KernelConfig = {\n kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nexport function identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
```





```

util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'/kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n
const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out =
backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize =
util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId,
CppType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n}\n\nexport const
argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as {}
as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //

```

```

strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat: " +\n `${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n
`was backend
only supports average pooling with dilation = [1, 1],` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as { } as KernelFunc\n};\n", "/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n
return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n", "/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number' // out_id\n]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:

```









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```
=====
*
import { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { sliceImplCPU } from
'./kernel_utils/shared';
export function slice(
 args: { inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm }) {
 const { inputs: { x }, attrs: { begin, size }, backend } = args;
 const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);
 const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);
 const xVals = backend.readSync(x.dataId);
 const out = backend.makeOutput(size_, x.dtype);
 const
xStrides = util.computeStrides(x.shape);
 const outData = backend.dataIdMap.get(out.dataId);
 if (isContinuous)
 {
 const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);
 if (x.dtype === 'string') {
 outData.stringBytes =
(xVals as Uint8Array[])
 .slice(flatOffset, flatOffset +
util.sizeFromShape(size_));
 } else {
 const outVals = backend.typedArrayFromHeap(out);
 outVals.set(
(xVals as TypedArray)
 .subarray(flatOffset, flatOffset +
util.sizeFromShape(size_)));
 }
 }
 return out;
}
if (x.dtype === 'string') {
 const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
 outData.stringBytes = res as Uint8Array[];
 return
out;
}
const outVals = backend.typedArrayFromHeap(out);
const rank = x.shape.length;
if (rank === 2)
{
 slice2d(
 xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],
size_ as
[number, number]);
} else if (rank === 3) {
 slice3d(
 xVals as TypedArray, xStrides[0], xStrides[1],
outVals,
 begin_ as [number, number, number], size_ as [number, number, number]);
} else if (rank === 4)
{
 slice4d(
 xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,
begin_ as [number,
number, number, number],
size_ as [number, number, number, number]);
} else {
 const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;
 outVals.set(res);
}
return
out;
}
function slice2d(
 xVals: backend_util.TypedArray, xStride: number,
outVals:
backend_util.TypedArray, begin: [number, number],
size: [number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const endI = beginI + size[0];
 for (let i = beginI; i < endI;
i++) {
 const xOffset = i * xStride + beginJ;
 outVals.set(xVals.subarray(xOffset, xOffset + size[1]),
outOffset);
 outOffset += size[1];
 }
}
function slice3d(
 xVals: backend_util.TypedArray, xStride1:
number, xStride2: number,
outVals: backend_util.TypedArray, begin: [number, number, number],
size:
[number, number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const beginK = begin[2];
 const endI = beginI + size[0];
 const endJ = beginJ + size[1];
 for (let i = beginI; i <
endI; i++) {
 for (let j = beginJ; j < endJ; j++) {
 const xOffset = i * xStride1 + j * xStride2 + beginK;
 outVals.set(xVals.subarray(xOffset, xOffset + size[2]),
outOffset);
 outOffset += size[2];
 }
 }
}
function slice4d(
 xVals: backend_util.TypedArray, xStride1: number, xStride2: number,
xStride3:
number, outVals: backend_util.TypedArray,
begin: [number, number, number, number],
size: [number, number, number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const beginK = begin[2];
 const endI = beginI + size[0];
 const endJ = beginJ + size[1];
 const endK = beginK
+ size[2];
 const beginL = begin[3];
 for (let i = beginI; i < endI; i++) {
 for (let j = beginJ; j < endJ; j++)
 {
 for (let k = beginK; k < endK; k++) {
 const xOffset = i * xStride1 + j * xStride2 + k * xStride3 +
beginL;
 outVals.set(xVals.subarray(xOffset, xOffset + size[3]),
outOffset);
 outOffset += size[3];
 }
 }
 }
}
export const sliceConfig: KernelConfig = {
 kernelName: Slice,
 backendName: 'wasm',
 kernelFunc: slice as { } as KernelFunc,
};
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```

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```
=====\n*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs: BatchToSpaceNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape, crops } = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({ inputs: { x }, backend, attrs: { shape: reshaped } });\n const xTransposed = transpose({ inputs: { x: xReshaped }, backend, attrs: { perm: permuted } });\n const xTransposedReshaped = reshape({ inputs: { x: xTransposed }, backend, attrs: { shape: reshapedPermuted } });\n const result = slice({ inputs: { x: xTransposedReshaped }, backend, attrs: { begin: sliceBeginCoords, size: sliceSize } });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function cast(\n args: { inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm }):\n TensorInfo {\n const { inputs: { x }, attrs: { dtype }, backend } = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n}\n\nfunction clip(args: {\n inputs: ClipByValueInputs,\n backend:
```

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BackendWasm,\n attrs: ClipByValueAttrs\n)) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId,\n clipValueMin, clipValueMax, outId);\n return out;\n}\n\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as\n KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*/\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from\n './kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\nexport function\n concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}\n = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape =\n backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors\n with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===\n 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,\n inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =\n $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===\n 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-\n dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by\n collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =\n util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},\n backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:\n backend.readSync(t.dataId, shape: t.shape)};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =\n inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,\n inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n\n const\n outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =\n backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =\n 0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
```







```

// filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number',
// outputChannels\n 'number', // outId\n);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend:
BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
Conv2D does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n",`/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //
outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number',
// fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n];\n}\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,

```

```

dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n
inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2,
xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n
yChannelStride, outId);\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
conv2DBackpropInput as { } as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast}
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n
'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n
'number' // out id\n]);\n\nfunction cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n
attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {method,
extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} = inputs;\n const numBoxes =
boxes.shape[0];\n\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape =
[numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n

```



```

permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n };\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs:
DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as { } as KernelFunc\n};\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:

```



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```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank\n }]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

```
=====\n*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

```
=====\n*\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmFlipLeftRight: (\n xId: number, batch:
```

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number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n
const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n const wasmFlipLeftRight = (\n imageId, batch,
imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {} as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const wasmBatchNorm = (\n xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n *
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*

```

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```
=====\n*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n */
```

```
=====\n*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {FusableActivation} from './types';\nlet wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {}] as keyof typeof FusableActivation;\n\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for FusedConv2D` +\n ` in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =\n backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
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(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from './backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const { inputs, attrs, backend } = args;\n const { x, filter, bias,
preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusibleActivation[activation as {}
as keyof typeof FusibleActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation}
activation not yet supported for FusedDepthwiseConv2D`\n +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got`\n +\n `rank ${biasData.shape.length}.`);\n }\n
if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not`\n +\n `match the number of output channels (${outputChannels})`);\n }\n
biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =

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convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n };\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize,
inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //
sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmGatherNd(\n xId, CCppType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,

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TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n"/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*\n\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
'./types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n}\n\nexport function leakyRelu(\n args: \n {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm}): \n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n

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backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the\n \* \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the\n \* License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or\n \* agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for\n \* the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }\n from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport\n { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMax: (xId:\n number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: { backend:\n BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { reductionIndices: axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,\n inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',\n axes, inputRank);\n\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the\n transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n }\n}
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setupFunc: setup,\n kernelFunc: max as { } as KernelFunc\n);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
```



```

*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs};\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n
reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean',
reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {\n
as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs};\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const
{axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes,
inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =

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backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n
kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n}\n\nfunction
mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const
{inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /*
beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n
'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n
]);\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs:
NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold,
maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n
// Since we are not using scores for V3, we have to delete it from the heap.\n
backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor
=\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as
KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n"/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in

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`non_max_suppression_impl.h`.ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`. \n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};\n}\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\nfunction nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {\n
as KernelFunc,\n};\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =

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backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc\n} as KernelFunc;\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```

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=====
\n
/\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null / void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\n function oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n }\n\n export const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot\n } as KernelFunc;\n\n "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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=====
\n
*/\n\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({input: t}, backend, attrs);\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n }\n }\n}
```

```

return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n }\n\n export const preluConfig:
KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n };\n "\n /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n "\n /*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from

```

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'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs:
ProdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let
reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n
 reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n\n*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {cast} from
'./Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n}\n\nfunction
resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners,
halfPixelCenters, size} = attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth,
numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n
cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc:

```

setup,\n kernelFunc: resizeBilinear as { } as KernelFunc\n};\n",/\*\n \* @license\n \* Copyright 2020 Google LLC.  
All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this  
file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*  
http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing,  
software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { util } from '@tensorflow/tfjs-core';\n\nexport function rangeImpl(start, stop, step, dtype) {\n const sameStartStop = start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const decreasingRangePositiveStep = stop < start && step > 1;\n if (sameStartStop || increasingRangeNegativeStep ||\n decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n }\n const numElements = Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\n if (stop < start && step === 1) {\n // Auto adjust the step's sign if it hasn't been set\n // (or was set to 1)\n step = -1;\n }\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n }\n return values;\n}\n\n#
```

sourceMappingURL=data:application/json;base64,eyJ2ZXJzZm9uIjozLCJmaWxlIjoiaU9uZmFuZ2VfaW1wbC5qcyIsInVudXJzZVJvb3QiOiIiLCJzbnVzY2VzIjpbIi4uLy4uLy4uLy4uLy4uLy4uL3RmanMmYmFja2VuZC1jcHUvc3JlL2tldm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJyYW1lcY16W10sIm1hcHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0dBZUc7QUFFSxPQUFFLEVBQWMsSUFBSxSUFQFDLE1BQU0sdUJQXVCLENBQUM7QUFFeEQsTUFBSxVQUFFVLFNBQVMsQ0FDckIsS0FBYSxQUFFLE1BQVksRUFBRsXJQUFFZLEVBQ3pDLEtBQXdcCO0IBQzFCLE1BQU0sYUFBYSxHQUFHLEtBQUssS0FBSyxJQUFFJLENBQUM7SUFdckMsTUFBTswyQkFBMkIsR0FBRYxLQUFFLEdBQUcsSUFBSxSUFQFDLE1BQU0sR0FBRYxDQUFFDLENBQUM7SUFdN0QsTUFBTswyQkFBMkIsR0FBRYxJQUFFJLEdBQUcsS0FBSyxJQUFFJLE1BQUksR0FBRYxDQUFFDLENBQUM7SUFFN0QsSUFBSxhQUFFhLE1BQUksMkJBQTJCO1FBQzVDLDJCQUEyQixFQUFFO1FBQy9CLE9BQU8sSUFBSxSUFQFDLGI1CQUFFtQixDQUFFDLENBQUMsRUFBRsXLE1BQU0sQ0FBQztlLQUMzQztlJQUFFVELE1BQU0sV0FBVyxBQUFFHLE1BQUksQ0FBQyxHQUFHLENBQUMsSUFBSxSUFQFDLE1BQUksQ0FBQyxDQUFFDLE1BQUksR0FBRYxLQUFFLENBQUMsR0FBRYxJQUFFJLENBQUMsQ0FBQyxDQUFFDLE1BQU0sTUFBTswyHQUFHLE1BQUksQ0FBQyxTQkFBbUIsQ0FBQyxXQUFFXLEVBQUUsS0FBSyxSUFQFDLENBQUM7SUFFN0QsSUFBSxSUFQFDLE1BQUcsS0FBSyxJQUFFJLE1BQUksS0FBSyxSUFQFDLE1BQU0sTUFBTswy9EO1FBQ3BELG9CQUFFvQjRQUFNwQixJQUFFJLEdBQUcsQ0FBQyxSUFQFDLENBQUM7S0FDWDJQUFFVELE1BQU0sQ0FBQyxSUFQFDLENBQUMsR0FBRYxLQUFFLENBQUM7SUFdDbEIsS0FBSyxJQUFFJLENBQUMsR0FBRYxDQUFFDLEVBQUUsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxNQFFNLEVBQUUsQ0FBQyxQUFFLEVBQUU7







```
'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] : [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\nfunction scatterNd(\n args: {\n backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} = scatter_util.calculateShapes(updates, indices, shape);\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates, stridesBytes, outputSize, outId);\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n */
```

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```
=====\n*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
```

```
 './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: {inputs: SelectInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n }\n\n export const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as KernelFunc,\n setupFunc: setup\n }; \n"/**\n *\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);\n\n function sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}) {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n return out;\n }\n\n export const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as KernelFunc\n }; \n"/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
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agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:\n number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\n function softmax(\n args: { backend: BackendWasm,\n inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =\n args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,\n logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return\n out;\n }\n\n export const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n * \n */\n}
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=====\n*\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from\n './unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * \n */\n
```

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=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { padV2Config } from\n './PadV2';\n\nimport { reshape } from './Reshape';\n\nimport { transpose } from './Transpose';\n\nfunction\n spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:\n SpaceToBatchNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape,\n paddings } = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number,\n number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 +\n blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX =\n padV2Config.kernelFunc({\n inputs: { x },\n backend,\n attrs: { paddings: completePaddings, constantValue:\n 0 }\n }) as TensorInfo;\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape,\n blockShape, prod, false);\n\n const permutedReshapedPaddedPermutation =\n backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapeInputs:\n ReshapeInputs = { x: paddedX };\n const reshapeAttrs: ReshapeAttrs = { shape: reshapedPaddedShape };\n const\n paddedXReshaped =\n reshape({ inputs: reshapeInputs, backend, attrs: reshapeAttrs });\n\n const transposeInputs:
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TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n
const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] =
s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n
return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName:
'wasm',\n kernelFunc: splitV as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n
'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {backend:
BackendWasm, inputs: StepInputs, attrs: StepAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId,
alpha, CCppType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName:
Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *
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2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', //
outShapeLength\n 'number', // outId\n]);\n}\n\nexport function stridedSlice(args: {\n backend: BackendWasm,\n
inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n
newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n
sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n
 x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n
let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x},
backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is
memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have
rank at least 1, got: ${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n
// To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x},

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backend, attrs: {begin: $begin, size});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:
finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out =
backend.makeOutput(finalShapeSparse, 'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes
= new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new
Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const
outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend:
BackendWasm, inputs: SumInputs, attrs: SumAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let\n inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,\n input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,\n input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n
const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n"/**\n *
@license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =
attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n
newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n
xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return
out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: tile as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or

```



agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n}\n\nexport const topk: (\n args: { inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs }) =>\n TensorInfo[] | TensorInfo = ({ inputs, backend, attrs }) => {\n const { x } = inputs;\n const { k, sorted } = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n}\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /* void */, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number', // outId\n]);\n}\n\nfunction transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n const out = backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imageData = backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n const
```

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interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n
break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n
outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId,
fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const transformConfig: KernelConfig = {\n
kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs});\n
TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;
i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n
for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\nexport const
unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n */\n\n//

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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
'./kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
'./kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
'./kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from

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./kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
./kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
./kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
./kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
./kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
./kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n \n absConfig,\n \n addConfig,\n \n addNConfig,\n \n allConfig,\n \n anyConfig,\n \n
argMaxConfig,\n \n avgPoolConfig,\n \n batchMatMulConfig,\n \n batchToSpaceNDConfig,\n \n castConfig,\n \n
ceilConfig,\n \n clipByValueConfig,\n \n concatConfig,\n \n conv2DConfig,\n \n conv2DBackpropInputConfig,\n \n
cosConfig,\n \n coshConfig,\n \n cropAndResizeConfig,\n \n cumsumConfig,\n \n depthToSpaceConfig,\n \n
depthwiseConv2dNativeConfig,\n \n eluConfig,\n \n equalConfig,\n \n expConfig,\n \n expandDimsConfig,\n \n fillConfig,\n
 \n flipLeftRightConfig,\n \n floorConfig,\n \n floorDivConfig,\n \n fusedMatMulConfig,\n \n fusedBatchNormConfig,\n
 \n fusedConv2DConfig,\n \n fusedDepthwiseConv2DConfig,\n \n gatherNdConfig,\n \n gatherV2Config,\n \n greaterConfig,\n
 \n greaterEqualConfig,\n \n identityConfig,\n \n leakyReluConfig,\n \n lessConfig,\n \n lessEqualConfig,\n \n logConfig,\n
 \n logicalAndConfig,\n \n maxConfig,\n \n maximumConfig,\n \n maxPoolConfig,\n \n meanConfig,\n \n minConfig,\n
 \n minimumConfig,\n \n mirrorPadConfig,\n \n multiplyConfig,\n \n negConfig,\n \n nonMaxSuppressionV3Config,\n
 \n

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nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n/**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}

```

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return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram="/.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"\\"}else{scriptDirectory=__dirname+"\\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"\\");arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire

```

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ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\\")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var

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u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023;if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAtAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof

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Module["postRun"]]=="function")Module["postRun"]=[Module["postRun"];while(Module["postRun"].length){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)function addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a pthread worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDependencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}if(dependenciesFulfilled){var callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module["preloadedAudios"]={};function abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.error("Pthread aborting at "+(new Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the wasm failed"}}catch(err){abort(err)}}function getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at "+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}}else{if(readAsync){return new Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function receiveInstance(instance,module){var exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-instantiate")})})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}}function receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling

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back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource))})))else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback=="function"){callback(Module);continue}var func=callback.func;if(typeof
func=="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOCSS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomics.notify returned an unexpected value
"+ret}Module["_emscripten_futex_wake"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in

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cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb)},initWorker:function(){,t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\\":\\"exit\\"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\\":\\"cancelDone\\"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.threads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+'\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\\"processQueuedMainThread
Work\\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\\"spawnThread\\"){spawnThread(e.data)}else
if(cmd===\\"cleanupThread\\"){cleanupThread(d["thread"])}}else
if(cmd===\\"killThread\\"){killThread(d["thread"])}}else

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if(cmd===\cancelThread\"){cancelThread(d[\thread\"])else
if(cmd===\loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\print\"){out(\Thread \"+d[\threadId\"]+\":
\"+d[\text\"])else if(cmd===\printErr\"){err(\Thread \"+d[\threadId\"]+\": \"+d[\text\"])else
if(cmd===\alert\"){alert(\Thread \"+d[\threadId\"]+\": \"+d[\text\"])else if(cmd===\exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\exitProcess\"){try{exit(d[\returnCode\"])catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\setimmediate\"){worker.postMessage(e.data)}else{err(\worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\pthread sent
an error! \"+e.filename+\":\"+e.lineno+\":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\message\",function(data){worker.onmessage({data:d
ata})});worker.on(\error\",function(data){worker.onerror(data)});worker.on(\exit\",function(data){})}worker.post
Message({\cmd\":\load\",urlOrBlob\":Module[\mainScriptUrlOrBlob\"]|_scriptDir,\wasmMemory\":wasmMe
memory,\wasmModule\":wasmModule}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\tfjs-
backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\unknown filename],line,func?UTF8ToString(func):\unknown
function\")}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\hrtime\"];return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\cmd\":\processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\targetThread\":targetThreadId,\cmd\":\processThreadQueu
e\"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\cmd\":\processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\timed-out\")return-

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73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atoms.wait returned an unexpected value
\"+ret}else{if(Atoms.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atoms.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retu
rn ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList

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});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function

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findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ext["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcount){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)}}return 1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:

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ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined){webGLContextAttributes.enableExtensions
ByDefault}{GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined){JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===`\`){name=name.slice(0,name.lastIndexOf(``))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GLctx.getNewId(GLctx.uniforms);utable[name]=[u.size,id];GLctx.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+`\`+j+`\`;loc=GLctx.getUniformLocation(p,n);id=GLctx.getNewId(GLctx.uniforms);GLctx.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GLctx.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return

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_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j]);num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! spawnThread()
can only ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`Internal
error!`;if(!threadParams.pthread_ptr)throw`Internal error, no pthread
ptr!`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;+i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","\start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`undefined`){err(`Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=`spawnThread`;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var

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tb=_pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
_emsripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\)}function
_emsripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!\);return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()===thread){err(\PThread
\'+thread+\ is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emsripten_main_browser_thread_id()===thread){err(\Main thread
\'+thread+\ is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!===thread){err(\pthread_join attempted on thread
\'+thread+\, which does not point to a valid thread, or does not exist anymore!\);return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\, which was already detached!\);return
ERRNO_CODES.EINVAL}if(block){_emsripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage(\cmd:\cleanupThread\,thread\);return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emsripten_main_thre
ad_process_queued_calls();_emsripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function _pthread_join(thread,status){return _emsripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\object\)return navigator[\hardwareConcurrency\]|1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emsripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\e\:__assert_fail,\r\:__call_main,\x\:_emsripten_notify_thread_queue,\b\:_abort,\y\:_
_emsripten_asm_const_int,\j\:_emsripten_conditional_set_current_thread_status,\d\:_emsripten_futex_wait,\
c\:_emsripten_futex_wake,\f\:_emsripten_get_now,\p\:_emsripten_memcpy_big,\A\:_emsripten_num_l
ogical_cores,\u\:_emsripten_receive_on_main_thread_js,\q\:_emsripten_resize_heap,\v\:_emsripten_set_ca

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nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[
\"asm\"][\"S\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"U\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"V\"]).apply(null,arguments
)};var
_Cosh=Module[\"_Cosh\"]=function(){return(_Cosh=Module[\"_Cosh\"]=Module[\"asm\"][\"W\"]).apply(null,argu
ments)};var
_CropAndResize=Module[\"_CropAndResize\"]=function(){return(_CropAndResize=Module[\"_CropAndResize\"]
=Module[\"asm\"][\"X\"]).apply(null,arguments)};var

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_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_"_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"ra"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"sa"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ta"]).apply(null,arguments)};var

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_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\ua]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\va]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\wa]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\xa]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\ya]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\za]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][\Aa]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][\Ba]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][\Ca]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\Da]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\Ea]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\Fa]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\Ga]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\Ha]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\Ia]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\Ja]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\Ka]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][\La]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][\Ma]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][\Na]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][\Oa]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][\Pa]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][\Qa]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][\Ra]).apply(null,arguments)};var

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_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Sa"]);
apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ta"]);ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Ua"]);.apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Va"]);.a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Wa"]);.apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Xa"]);.apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"]["Ya"]);.apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Za"]);.apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"]["_a"]);.apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]);.apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]);.apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]);.apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]);.apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]);.apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]);.apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb
b"]);.apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb
b"]);.apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"]["hb"]);.apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]);.apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]);.apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"]["kb"]);.apply(null,arguments)};var
_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=function(){return(_emsripten_get_global
_libc=Module["_emsripten_get_global_libc"]=Module["asm"]["lb"]);.apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["as
m"]["mb"]);.apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]);.apply(null,arguments)};var

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_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=function(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=function(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){return(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsripten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Module["__emsripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["zb"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"]]).apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=Module["asm"][["Bb"]]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"][["Cb"]]).apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=10512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module["ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromiseResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){return}function

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doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus\"])Module["setStatus\"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus\"]("\\"),1);doRun(),1)}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit\"])Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit\"])if(typeof
Module["preInit"]===\function\"){Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n);nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"] =
WasmBackendModuleThreadedSimd;\n", "\nvar WasmBackendModule = (function() {\n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=""";function
locateFile(path){if(Module["locateFile\"])return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\path\").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs");if(!nodePath)nodePath=require(\path");filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync"](filename,binary?null:\utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,\^");arguments_=process["arg
v"].slice(2);process["on"](\uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"](\unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return["Emscripten Module object"]}]}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,\binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof

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arguments!=="undefined"){arguments_=arguments}if(typeof
quit===\function\"){quit_=function(status){quit(status)}if(typeof print!=="undefined"){if(typeof
console===\undefined\"){console={};console.log=print;console.warn=console.error=typeof
printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\blob:\")!=0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\^")+1)}else{scriptDirectory=""}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} else { var
out=Module[\print\]||console.log.bind(console);var err=Module[\printErr\]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\])arguments_=Module[\arguments\];if(Module[\thisProgram\])thisProgram=
Module[\thisProgram\];if(Module[\quit\])quit_=Module[\quit\];var
wasmBinary;if(Module[\wasmBinary\])wasmBinary=Module[\wasmBinary\];var
noExitRuntime=Module[\noExitRuntime\]||true;if(typeof WebAssembly!=="object"){abort(\no native wasm
support detected)}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module[_"+ident];assert(func,\Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={\string\":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\)return UTF8ToString(ret);if(returnType===\boolean\)return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function

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UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;+i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepen
dencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function

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getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"} }catch(err){abort(err)} }function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\function\&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){if(!response[\ok\]){throw"failed to load wasm binary file at
\"+wasmBinaryFile+\""}return response[\arrayBuffer\]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\asm\]=exports;wasmMemory=Module[\asm\][\j\];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\asm\][\r\];removeRunDependency(\wasm-
instantiate\)}addRunDependency(\wasm-instantiate\);function
receiveInstantiatedSource(output){receiveInstance(output[\instance\])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\wasm streaming compile failed: \"+reason);err(\falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\instantiateWasm\]){try{var
exports=Module[\instantiateWasm\](info,receiveInstance);return exports }catch(e){err(\Module.instantiateWasm
callback failed with error: \"+e);return false }}instantiateAsync().catch(rejectPromise);return{ }}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue }var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false }for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true }}return false }var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){var num=0;for(var

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i=0;i<iocvnt;i++){ var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j]))num+=len}HEAP32[pnum>>2]=num;return 0}function
_pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]|1;return 1 } }setErrNo(28);return-1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var

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_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"])[["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"])[["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"])[["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"])[["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"])[["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"])[["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"])[["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"])[["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"])[["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"])[["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"])[["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"])[["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"])[["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"])[["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"])[["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"])[["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"])[["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"])[["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"])[["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"])[["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"])[["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"])[["U"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"])[["V"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"])[["W"]]).apply(null,arguments)};var

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_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_X]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_Y]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_Z]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_$]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_aa]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_ba]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_ca]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_da]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_ea]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_fa]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_ga]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_ha]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_ia]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_ja]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_ka]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_la]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_ma]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_na]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_oa]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_pa]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_qa]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_ra]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_sa]).apply(null,arguments)};var

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_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]["ta"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]["ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]["va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]["wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]["xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["Qa"]).apply(null,arguments)};var

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_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra
a")]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["Sa")]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta")]).apply(nu
ll,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua")]).apply(null,argument
s)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["Va")]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa")]).
apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["Xa")]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"
]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);};\n\n\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\n\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\n\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\n\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n\n@ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\n\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n

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this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:\n number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return\n this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =\n util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:\n DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n }\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *\n util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values\n as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\n this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n }\n this.dataIdMap.delete(dataId);\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():\n 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:\n false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this\n * method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated\n * elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:\n number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset\n == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =\n this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const\n {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new\n Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,\n size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n function\n createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
```





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});\n });\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n
throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-
wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\nconst
WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:
string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet
customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n * \n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*\n * export function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n
 '\n `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n * \n * \n * \n * setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * \n * tf.setBackend('wasm');\n *
\n * \n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n *
SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n *
full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located
in the same directory, or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional
boolean to use platform fetch to download\n * the wasm file, default to false.\n * \n * @doc {heading:
'Environment', namespace: 'wasm'}\n * \n * export function setWasmPaths(\n prefixOrFileMap: string|{\n [key in
WasmBinaryName]?: string;\n },\n usePlatformFetch = false): void {\n if (initAborted) {\n throw new Error(\n
'The WASM backend was already initialized. Make sure you call ' +\n '\n `setWasmPaths()` before you call
`tf.setBackend()` or ' +\n '\n `tf.ready()`);\n }\n \n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix
= prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw new
Error(\n `There were no entries found for the following binaries: ` +\n `${missingPaths.join(',')}. Please
either call setWasmPaths with a ` +\n `map providing a path for each binary, or with a string indicating ` +\n
 `the directory where all the binaries can be found.`);\n }\n }\n \n customFetch = usePlatformFetch;\n}\n\n/**
Used in unit tests. *\n * export function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n
wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n * \n * This must be called before calling
`tf.setBackend('wasm')`.\n * \n * export function setThreadsCount(numThreads: number) {\n threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * \n * It is set after the
backend is initialized.\n * \n * export function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n
throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\n}\n\n",\nexport const
wasmWorkerContents = `var Module={};function threadPrintErr(){var
text=Array.prototype.slice.call(arguments).join("\\ ");console.error(text)}function threadAlert(){var
text=Array.prototype.slice.call(arguments).join("\\ ");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new

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WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
return instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\"load\"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===\"string\"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===\"objectTransfer\"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init\""](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace\""](top,max);Module["__emscripten_tls_init\""](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
\""](),1);try{var
result=Module["invokeEntryPoint\""](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime\""]())Module["
PThread"].threadExit(result)}catch(ex){if(ex===\"Canceled!\"){Module["PThread"].threadCancel()}else
if(ex!==\"unwind\")if(ex instanceof
Module["ExitStatus\"]){if(Module["getNoExitRuntime\""]()){else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw ex}}}}else
if(e.data.cmd===\"cancel\")if(Module["_pthread_self\""]()){Module["PThread"].threadCancel()}else
if(e.data.target===\"setimmediate\")else
if(e.data.cmd===\"processThreadQueue\")if(Module["_pthread_self\""]){Module["__emscripten_current_thread_
process_queued_calls\""]()}else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\")self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\")performance={now:function(){return Date.now()}}};\"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n\n const {wasm} = await init();\n\n return new
BackendWasm(wasm);\n\n}, WASM_PRIORITY);\n\n\"/** @license See the LICENSE file. *\n\n// This code is
auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport
{version};\n\n\"names\":[\"CppDType\", \"FusableActivation\", \"wasmFusedMatMul\", \"fusedMatMulConfig\", \"kernelNa
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No license file was found, but licenses were detected in source scan.

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*\n\n// Import core for side effects (e.g. flag registration)\nimport '@tensorflow/tfjs-core';\n\n// tslint:disable-next-line:no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/public/chained_ops/register_all_chained_ops';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/register_all_gradients';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {setTestEnvs, setupTestFilters, TestFilter} from '@tensorflow/tfjs-core/dist/jasmine_util';\n\nsetTestEnvs({ name: 'test-wasm', backendName: 'wasm', isDataSync: true});\n\n/**\n * Tests that have these substrings in their name will be included unless one\n * of the strings in excludes appears in the name.\n */\nconst TEST_FILTERS: TestFilter[] = [\n {\n startsWith: 'tensor',\n excludes: [\n 'complex', // Complex numbers not supported yet\n 'derivative', // Gradients not yet supported.\n 'Downcasting broken, see: https://github.com/tensorflow/tfjs/issues/2590\n 'Tensor2D float32 -> bool',\n 'Tensor2D int32 -> bool'\n],\n include: 'softmax',\n {\n include: 'pow',\n excludes: [\n 'gradient', // zerosLike not defined yet.\n 'broadcasting same rank Tensors different shape', // Broadcasting along\n // inner dims not\n // supported yet.\n]\n },\n {\n include: 'add',\n excludes: [\n 'gradient', // Gradient is missing.\n 'upcasts when dtypes dont match', // Uses the 'complex' dtype.\n 'complex', // Complex numbers not supported yet\n]\n },\n {\n include: 'depthToSpace',\n {\n include: 'avgPool',\n excludes: [\n 'gradient', // Not yet implemented.\n 'avgPool3d', // Not yet implemented.\n]\n },\n {\n include: 'relu',\n excludes: [\n 'derivative', // Not yet implemented.\n 'gradient', // Not yet implemented.\n 'valueAndGradients', // Not yet implemented.\n 'broadcasted bias', // Not yet implemented.\n 'fused A x B with 2d bias' // Fused matMul with 2D bias not yet\n // supported.\n]\n },\n {\n include: 'maxPool',\n excludes: [\n 'maxPoolBackprop', // Not yet implemented.\n 'maxPool3d', // Not yet implemented.\n 'maxPool3dBackprop', // Not yet implemented.\n 'ignores NaNs', // Actual != expected.\n 'maxPoolWithArgmax' // Not yet implemented.\n]\n },\n {\n include: 'cropAndResize',\n },\n {\n include: 'resizeBilinear',\n excludes: [\n 'gradients', // Not yet implemented.\n]\n },\n {\n include: 'matmul',\n excludes: [\n 'valueAndGradients', // Gradients not defined yet\n 'gradient', // Gradients not defined yet\n 'zero in its shape', // Zero in shapes aren't supported yet\n 'matmul followed by mul', // mul not supported yet\n 'upcasts', // Upcasting not supported yet.\n 'fused A x B with 2d bias', // Fused matMul with 2D bias not yet\n // supported.\n]\n },\n {\n include: 'depthwiseConv2D',\n excludes: [\n 'broadcasted bias', // Broadcasted bias not yet supported.\n 'gradient', // Gradients not defined yet.\n 'NCHW', // xnn pack does not support channels first.\n]\n },\n {\n include: 'conv2d',\n excludes: [\n 'broadcasted bias', // Broadcasted bias not yet supported.\n 'gradient', // Gradients not defined yet.\n 'backProp input x=[2,3,3,1] f=[2,2,1,1] s=1 p=0', // Gradients not\n // defined.\n 'NCHW', // xnn pack does not support channels first. // Issue: https://github.com/tensorflow/tfjs/issues/3104.\n // Actual != expected.\n 'relu bias stride 2 x=[1,8,8,16] f=[3,3,16,1] s=[2,2] d=8 p=same',\n 'prelu bias stride 2 x=[1,8,8,16] f=[3,3,16,1] s=[2,2] d=8 p=same',\n]\n },\n {\n include: 'conv2dTranspose',\n excludes: ['gradient']\n },\n {\n include: 'prelu',\n excludes: [\n 'gradient', // Gradient is missing.\n 'derivative' // Missing gradient.\n]\n },\n {\n include: 'cast',\n excludes: [\n 'complex', // Complex numbers not yet implemented.\n 'shallow slice an input that was cast' // Slice is not implemented.\n]\n },\n {\n include: 'gather',\n excludes: [\n 'gradient' // Not yet implemented.\n]\n },\n {\n include: 'sigmoid',\n excludes: [\n 'sigmoidCrossEntropy', // Not yet implemented.\n 'gradient' // Not yet implemented.\n]\n },\n {\n include: 'scatterND',\n },\n {\n include: 'abs',\n excludes: [\n 'gradient', // Not yet implemented.\n 'complex' // Complex numbers not supported yet.\n]\n },\n {\n include: 'sub',\n excludes: [\n 'complex', // Complex numbers not yet implemented.\n 'gradient', // Not yet implemented.\n 'upcasts', // Upcasting not supported yet.\n]\n },\n {\n include: 'mul',\n excludes: [\n 'complex', // Complex numbers not yet supported.\n 'gradient', // Gradient not defined yet.\n]\n },\n {\n include: 'div',\n excludes: [\n 'gradient', // Gradient not defined yet.\n 'upcasts', // Cast not supported yet.\n 'divNoNaN' // divNoNaN not yet implemented.\n]\n },\n {\n include: 'batchNorm',\n excludes: [\n 'gradient' // Gradient\n]\n }\n]\n];
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is missing.\n]\n },\n {include: 'slice'},\n {include: 'stridedSlice'},\n {include: 'rotate'},\n {include:
'rotateWithOffset'},\n {include: 'flipLeftRight'},\n {include: 'square'},\n {include: 'squaredDifference'},\n {\n
startsWith: 'min ',\n excludes: [\n '2D, axis=0', // Permuted axes requires transpose, which is not yet\n
// implemented.\n 'index corresponds to start of a non-initial window', // argMin not yet\n
// implemented.,\n 'gradient' // Gradients not yet implemented\n]\n },\n {\n startsWith: 'max
',\n excludes: [\n 'gradient' // Gradients not yet implemented\n]\n },\n {\n include: 'concat',\n excludes:
[\n 'complex', // Complex numbers not supported yet\n 'gradient' // Split is not yet implemented\n]\n },\n
{\n include: 'transpose'},\n {\n include: 'oneHot'},\n {\n include: 'split'},\n {\n include: 'pad ', excludes: ['complex',
'zerosLike']},\n {\n include: 'clip',\n excludes: [\n 'gradient',\n 'propagates NaNs' // clip delegates to
XNNPACK which does not make\n // guarantees about behavior of nans.\n]\n },\n {\n include:
'addN'},\n {\n include: 'nonMaxSuppression'},\n {\n include: 'argmax', excludes: ['gradient']},\n {\n include: 'exp '},\n {\n
include: 'elu',\n excludes: [\n 'derivative', // Not yet implemented.\n 'gradient', // Not yet implemented.\n
'selu' // Not yet implemented.\n]\n },\n {\n include: 'unstack'},\n {\n include: 'minimum',\n excludes: [\n
'gradient', // Not yet implemented.\n 'broadcasts 2x1 Tensor2D and 2x2 Tensor2D' //
Broadcasting along inner\n // dims not supported yet.\n]\n },\n {\n include:
'maximum',\n excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasts 2x1
Tensor2D and 2x2 Tensor2D' // Broadcasting along inner\n // dims not supported
yet.\n]\n },\n {\n include: 'log ',\n },\n {\n startsWith: 'equal ',\n excludes: [\n 'broadcasting Tensor2D
shapes', // Broadcasting along outer dims not\n // supported yet.\n 'broadcasting
Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n
{\n include: 'greater ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims
not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n
'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'greaterEqual',\n
excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasting Tensor2D shapes', //
Broadcasting along outer dims not\n // supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n
'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include:
'less ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n
// supported yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor3D
float32', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n
include: 'lessEqual',\n excludes: [\n 'gradient', // Not yet implemented.\n 'broadcasting
Tensor2D shapes', // Broadcasting along outer dims not\n // supported yet.\n
'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor3D float32', // Same as above.\n
'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n]\n },\n {\n include: 'notEqual',\n excludes:
[\n 'broadcasting Tensor2D shapes', // Broadcasting along outer dims not\n // supported
yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as
above.\n 'string'\n]\n },\n {\n include: 'mean ',\n excludes: [\n 'axis=0', // Reduction not supported
along inner dimensions.\n]\n },\n {\n startsWith: 'reverse'},\n {\n startsWith: 'sum'},\n {\n startsWith: 'cumsum'},\n
{\n startsWith: 'logicalAnd ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along outer
dimensions\n // not yet supported.\n 'broadcasting Tensor3D shapes', // Same as above.\n
'broadcasting Tensor4D shapes', // Same as above.\n]\n },\n {\n startsWith: 'tile ',\n excludes: [\n
'gradient', // Gradient not yet implemented.\n 'string tensor' // String tensors not yet implemented.\n]\n },\n
{\n startsWith: 'sin ',\n {\n startsWith: 'cos ',\n excludes: [\n 'gradient', // Gradient not yet implemented.\n]\n },\n
{\n startsWith: 'cosh',\n excludes: [\n 'gradient' // Gradient not yet implemented.\n]\n },\n {\n
startsWith: 'tan',\n excludes: ['gradient'] // Gradient not yet implemented.\n\n },\n {\n startsWith: 'tanh ',\n
excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n startsWith: 'rsqrt ',\n excludes: ['gradient'] //
Gradient not yet implemented.\n },\n {\n startsWith: 'sqrt ',\n excludes: ['gradient'] // Gradient not yet
implemented.\n },\n {\n startsWith: 'where ',\n excludes: [\n '1D condition with higher rank a and b', // Fill
not yet implemented.\n 'gradient' // Gradient not yet implemented.\n]\n },\n {\n

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 \* =====\*/

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AA6B;CAC1C,CAAC", "sourcesContent":["/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights  
Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file  
except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*  
http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing,  
software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport\n{ BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:\nBackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.toArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const\nzerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike\nas { } as KernelFunc,\n};\n"]}
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Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ZerosLike.js.map

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Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
```

```
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n }\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n"]}
```

Found in path(s):

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aAAa,GAAiB;IACzC,UAAU,EAAE,OAAO;IACnB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACbB,
UAAU,EAAE,OAA2B;CACxC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2020 Google LLC. All
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n *\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {logits} = inputs;\n const {dim} = attrs;\n\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n }\n return out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Softmax.js.map
```

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

```
{ "version":3,"file":"tf-backend-wasm.es2017.min.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/kernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../src/kernels/Conv2D.ts","../src/kernels/Conv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kernels/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/FlipLeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../src/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/Maximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/NotEqual.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/Range.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Softmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","../src/kernels/Sub.ts","../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm.js","../src/backend_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js","../src/base.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * \n * \n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
```

enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6}\n"},/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from\n './types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //\n leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs:\n _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const { inputs, backend,\n attrs } = args;\n const { a, b, bias, preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==\n 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank\n ${biasData.shape.length}`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId =\n preluActivationWeights == null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const\n fusedActivation =\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if\n (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet supported for\n FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out =\n backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n }\n\n export const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n };\n"},/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport\n { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function\n createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
```



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```
=====\n*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmFunc: (inputIds: Uint8Array, inputIdsLen: number, dtype: number, outId: number) => void;\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n const inputIds = inputs.map(x => backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length, CCppType[out.dtype], outId);\n return out;\n}\nexport const addNConfig: KernelConfig = {\n kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nexport function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
```





```

permutedAxes }, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
}\n }\n\n return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n\n}"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null
/*void*/, ['number, number, number']);\n}\n\nfunction all(args: { backend: BackendWasm, inputs: AllInputs, attrs:
AllAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x
} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as { } as KernelFunc\n};\n}"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x
} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis,
backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =

```

```

util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'/kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n
const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out =
backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize =
util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId,
CppType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n}\n\nexport const
argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as {}
as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //

```

```

strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat: " +\n `${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n
`was backend
only supports average pooling with dilation = [1, 1],` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as { } as KernelFunc\n};\n", "/**\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n
return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n", "/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number' // out_id\n]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:

```







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```
=====
*
import { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { sliceImplCPU } from
'./kernel_utils/shared';
export function slice(
 args: { inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm }) {
 const { inputs: { x }, attrs: { begin, size }, backend } = args;
 const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);
 const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);
 const xVals = backend.readSync(x.dataId);
 const out = backend.makeOutput(size_, x.dtype);
 const
xStrides = util.computeStrides(x.shape);
 const outData = backend.dataIdMap.get(out.dataId);
 if (isContinuous)
 {
 const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);
 if (x.dtype === 'string') {
 outData.stringBytes =
(xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));
 } else {
 const outVals = backend.typedArrayFromHeap(out);
 outVals.set(
(xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_)));
 }
 }
 return out;
}
if (x.dtype === 'string') {
 const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
 outData.stringBytes = res as Uint8Array[];
 return
out;
}
const outVals = backend.typedArrayFromHeap(out);
const rank = x.shape.length;
if (rank === 2)
{
 slice2d(
xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],
size_ as
[number, number]);
} else if (rank === 3) {
 slice3d(
xVals as TypedArray, xStrides[0], xStrides[1],
outVals,
begin_ as [number, number, number], size_ as [number, number, number]);
} else if (rank === 4)
{
 slice4d(
xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,
begin_ as [number,
number, number, number],
size_ as [number, number, number, number]);
} else {
 const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;
 outVals.set(res);
}
return
out;
}
function slice2d(
 xVals: backend_util.TypedArray, xStride: number,
 outVals:
backend_util.TypedArray, begin: [number, number],
size: [number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const endI = beginI + size[0];
 for (let i = beginI; i < endI;
i++) {
 const xOffset = i * xStride + beginJ;
 outVals.set(xVals.subarray(xOffset, xOffset + size[1]),
outOffset);
 outOffset += size[1];
 }
}
function slice3d(
 xVals: backend_util.TypedArray, xStride1:
number, xStride2: number,
 outVals: backend_util.TypedArray, begin: [number, number, number],
size:
[number, number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const beginK = begin[2];
 const endI = beginI + size[0];
 const endJ = beginJ + size[1];
 for (let i = beginI; i <
endI; i++) {
 for (let j = beginJ; j < endJ; j++) {
 const xOffset = i * xStride1 + j * xStride2 + beginK;
 outVals.set(xVals.subarray(xOffset, xOffset + size[2]),
outOffset);
 outOffset += size[2];
 }
 }
}
function slice4d(
 xVals: backend_util.TypedArray, xStride1: number, xStride2: number,
xStride3:
number, outVals: backend_util.TypedArray,
begin: [number, number, number, number],
size: [number, number, number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const beginK = begin[2];
 const endI = beginI + size[0];
 const endJ = beginJ + size[1];
 const endK = beginK
+ size[2];
 const beginL = begin[3];
 for (let i = beginI; i < endI; i++) {
 for (let j = beginJ; j < endJ; j++)
 {
 for (let k = beginK; k < endK; k++) {
 const xOffset = i * xStride1 + j * xStride2 + k * xStride3 +
beginL;
 outVals.set(xVals.subarray(xOffset, xOffset + size[3]),
outOffset);
 outOffset += size[3];
 }
 }
 }
}
export const sliceConfig: KernelConfig = {
 kernelName: Slice,
 backendName: 'wasm',
 kernelFunc: slice as { } as KernelFunc,
};
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```

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```
=====\n*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs: BatchToSpaceNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape, crops } = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({ inputs: { x }, backend, attrs: { shape: reshaped } });\n const xTransposed = transpose({ inputs: { x: xReshaped }, backend, attrs: { perm: permuted } });\n const xTransposedReshaped = reshape({ inputs: { x: xTransposed }, backend, attrs: { shape: reshapedPermuted } });\n const result = slice({ inputs: { x: xTransposedReshaped }, backend, attrs: { begin: sliceBeginCoords, size: sliceSize } });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function cast(\n args: {\n inputs: CastInputs,\n attrs: CastAttrs,\n backend: BackendWasm\n }): TensorInfo {\n const { inputs: { x }, attrs: { dtype }, backend } = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backendtypedArrayFromHeap(x);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(inVals);\n\n return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { KernelConfig, Ceil } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
```



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```
=====\n*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\n number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =\n backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //\n max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:\n BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId,\n clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as\n KernelFunc\n }; \n "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
```

```
=====\n*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concatImplCPU } from\n '../kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nexport function\n concat(\n args: {\n inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs\n }) {\n const {inputs, backend}\n = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =\n backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors\n with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===\n 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,\n inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =\n $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===\n 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-\n dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than\n the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by\n collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =\n util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},\n backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:\n backend.readSync(t.dataId, shape: t.shape)};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =\n inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,\n inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n out.shape = finalOutShape;\n const\n outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =\n backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =\n 0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
```





```

// filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', //
dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number',
// outputChannels\n 'number', // outId\n);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend:
BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
Conv2D does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //
outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number',
// fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n];\n}\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,

```

```

dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n
inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2,
xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n
yChannelStride, outId);\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
conv2DBackpropInput as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n", "/*\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }

```



```

permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n };\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs:
DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as { } as KernelFunc\n};\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:

```





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```
=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n inputRank\n }]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmFlipLeftRight: (\n xId: number, batch:
```

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number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n
const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n wasmFlipLeftRight(\n imageId, batch,
imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {} as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing\n * permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing\n * permissions and\n * limitations under the License.\n *
=====\n
*\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing\n * permissions and\n * limitations under the License.\n *
=====\n
*\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?

```

```

backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
\n\nimport { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null / void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusibleActivation[activation as { } as keyof typeof FusibleActivation];\n if (fusedActivation == null) {\n throw new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n ` in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if

```

```

(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights === null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { FusibleActivation } from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const { inputs, attrs, backend } = args;\n const { x, filter, bias,
preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusibleActivation[activation as {}
as keyof typeof FusibleActivation];\n if (fusedActivation === null) {\n throw new Error(\n `${activation}
activation not yet supported for FusedDepthwiseConv2D`\n +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias !== null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got`\n +\n `rank ${biasData.shape.length}.`);\n }\n
if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not`\n +\n `match the number of output channels (${outputChannels})`);\n }\n
biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =

```

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convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n };\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize,
inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

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=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CCppType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //
sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmGatherNd(\n xId, CCppType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,

```

```

TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}

```

from './binary\_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/\*\n \* @license\n \* Copyright 2019\n \* Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you\n \* may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing,\n \* software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES\n \* OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language\n \* governing permissions and\n \* limitations under the License.\n \*/

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from\n './types';\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,\n null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //\n out_id\n]);\n}\nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n backend: BackendWasm\n }):\n TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either\n float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape)\n !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,\n outId);\n }\n return out;\n }\n}\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n
```

```
*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
 agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
 {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\nlet wasmMax: (xId:
 number, dtype: number, reduceSize: number, outId: number) =>\n void;\nfunction setup(backend:
 BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n
 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\nfunction max(args: {backend:
 BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
 const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
 inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
 transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
 axes, inputRank);\n const [outShape, reduceShape] =\n
 backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
 transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n
 const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n
 return out;\n}\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n
 setupFunc: setup,\n kernelFunc: max as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google
 LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
 use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
```



```

'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n

=====*\n\nimport { backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util }\nfrom '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nlet wasmMaxPool: (\n xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:\n number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =\n backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //\n inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //\n padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //\n dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //\n // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\nfunction maxPool(\n args:\n {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =\n args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n // TF API\n supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it\n because it uses xnnpack which only\n // supports float32.\n // Add the following assert only for the WASM\n backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype\n === 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n const\n {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight =\n convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const\n padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =\n convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =\n convInfo.outChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm\n backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],\n filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\nexport const maxPoolConfig:\nKernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool\n} as KernelConfig;\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n

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*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs};\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n
reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean',
reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {\n
as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs};\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const
{axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes,
inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =

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backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n } \n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n
kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n}\n\nfunction
mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const
{inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /*
beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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=====\n*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport { BackendWasm } from '../backend_wasm';\n\n// Analogous to `struct Result` in `non_max_suppression_impl.h`\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/**\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`\n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset: number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,\n NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n],\n);\n\n function kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
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resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n
// Since we are not using scores for V3, we have to delete it from the heap.\n
backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor
=\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {}
as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =

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=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

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=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({input: t}, backend, attrs: {dim: axis});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n }\n }\n}
```

```

return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n }\n\n export const preluConfig:
KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n };\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from

```







YWx1ZXNbaV0gPSB2YWx1ZXNbaSAtdFdcSgc3RlcDtcbiAgfVxuICByZXR1cm4gdmFsdWVzO1xufVxuIl19"  
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Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may  
obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by  
applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\"  
BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the  
License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
 './binary_kernel';\n\nconst supportsFullBroadcast = true;\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n", /*\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
 './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
 \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
 './unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from
 './Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
 backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n\n function
resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }):
TensorInfo {\n const { backend, inputs, attrs } = args;\n\n const { images } = inputs;\n const { alignCorners,
halfPixelCenters, size } = attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth,
numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =
```



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'number', // outId\n]);\n}\n\nexport function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] : [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n function scatterNd(\n args: {\n backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n const out = backend.makeOutput(shape, updates.dtype);\n if
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(util.sizeFromShape(shape) === 0) {\n return out;\n } \n\n const { sliceRank, numUpdates, sliceSize, strides,
outputSize } =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,
stridesBytes, outputSize, outId);\n\n return out;\n }\n\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

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=====\n
*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number,
offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: { inputs: SelectInputs, backend:
BackendWasm }) {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n }\n\n export
const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {}
as KernelFunc,\n setupFunc: setup\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n\n function sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
= backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId,
outId);\n return out;\n }\n\n export const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n };\n", "/*\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
```

agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmFunc: (xId: number, outId: number, channels: number, batch: number) =>\n void;\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n}\nfunction softmax(\n args: {backend: BackendWasm, inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): \n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} = args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape, logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n wasmFunc(xId, outId, channels, batch);\n return out;\n}\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {padV2Config} from './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\nfunction spaceToBatchND(\n args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<number, number> = [[0, 0]];\n completePaddings.push(...(paddings as Array<number, number>));\n for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX = padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n const transposeInputs:
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TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n
const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] =
s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n
return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName:
'wasm',\n kernelFunc: splitV as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*/\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for

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the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n\n function step(\n args: {\n backend: BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n }\n\n export const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array, xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n\n export function stridedSlice(\n args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } = slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x},
```

```

backend, attrs: {begin: $begin, size});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:
finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out =
backend.makeOutput(finalShapeSparse, 'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes
= new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new
Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const
outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n"/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: {backend:
BackendWasm, inputs: SumInputs, attrs: SumAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let\n inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,\n input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,\n input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n

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wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *"
```

```
=====\n\n*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *"
```

```
=====\n\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *"
```

```
=====\n\n*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //\n x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]);\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n\n return\n out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
```

software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk: (\n args: { inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs }) =>\n TensorInfo[] | TensorInfo = ({ inputs, backend, attrs }) => {\n const { x } = inputs;\n const { k, sorted } = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as { } as KernelFunc,\n };,\n /**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n }\n}
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /* void */, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number', // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n const out = backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imageData = backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n const
```

```

interpolationModeId = interpolation === 'nearest' ? 1 : 2;
let fillModeId;
switch (fillMode) {
 case 'constant':
 fillModeId = 1;
 break;
 case 'reflect':
 fillModeId = 2;
 break;
 case 'wrap':
 fillModeId = 3;
 break;
 case 'nearest':
 fillModeId = 4;
 break;
 default:
 fillModeId = 1;
 break;
}
wasmTransform(
 imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,
 outWidth, numChannels, imageWidth, imageHeight, strides,
 image.shape.length - 1, interpolationModeId,
 fillModeId, fillValue, outId);
return out;
}
export const transformConfig: KernelConfig = {
 kernelName: Transform,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: transform as { } as
 KernelFunc;
};
"/**
 * @license
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 */

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```

=====
*/
import { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
 '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { slice } from
 './Slice';
function unpack(
 args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):
 TensorInfo[] {
 const { inputs, backend, attrs } = args;
 const { value } = inputs;
 let { axis } = attrs;
 if (axis <
 0) {
 axis += value.shape.length;
 }
 const numOutputs = value.shape[axis];
 const rank =
 value.shape.length;
 const outShape: number[] = new Array(rank - 1);
 let outIndex = 0;
 for (let i = 0; i < rank;
 i++) {
 if (i !== axis) {
 outShape[outIndex++] = value.shape[i];
 }
 }
 const outs: TensorInfo[] = new
 Array(numOutputs);
 const begin = new Array(rank).fill(0);
 const size = value.shape.slice();
 size[axis] = 1;
 for (let i = 0; i < outs.length; i++) {
 begin[axis] = i;
 outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },
 backend });
 }
 return outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));
}
export const
unpackConfig: KernelConfig = {
 kernelName: Unpack,
 backendName: 'wasm',
 kernelFunc: unpack as { } as
 KernelFunc;
};
"/**
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 implied.
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 limitations under the
 License.
 */

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=====
*/
import { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';
import
{ BackendWasm } from '../backend_wasm';
function zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {
 const { inputs: { x }, backend } = args;
 const out = backend.makeOutput(x.shape, x.dtype);
 const outVals = backend.typedArrayFromHeap(out);
 outVals.fill(0);
 return out;
}
export const
zerosLikeConfig: KernelConfig = {
 kernelName: ZerosLike,
 backendName: 'wasm',
 kernelFunc: zerosLike
as { } as KernelFunc;
};
"/**
 * @license
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 implied.
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 limitations under the
 License.
 */

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*/

```

We explicitly import the modular kernels so they get registered in the global registry when we compile the

library. A modular build would replace the contents of this file and import only the kernels that are needed.

```

\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
 './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
 {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}
from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
 {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
 {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
 {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
 {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
 {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
 {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
 {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
 {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
 {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
 {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
 {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
 {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
 {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
 './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
 {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport

```

```

{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n
 argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n
 ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n
 cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n
 depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n
 flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n
 fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n
 greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n
 logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n
 minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
 nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
 onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
 realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
 rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
 sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
 squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
 tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
 zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n\n"/**\n *
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 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
*\n\nimport {env} from '@tensorflow/tfjs-core';\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
 passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
 contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
 Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
 11\n]));\n\n/**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
 feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
 TODO(annxingyuan): Enable node support once this is resolved:\n //
 https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
 Test for transferability of SABs (needed for Firefox)\n //
 https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
 MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
 program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
 11\n]));\n } catch (e) {\n return false;\n };\n\n"/**\n * nvar WasmBackendModuleThreadedSimd = (function() {\n
 var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
 undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
 (\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
 WasmBackendModuleThreadedSimd || {};\n\nfunction
 GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}

```

```

return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram="/.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire

```



```

ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\\")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var

```

```

u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++
]=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAtAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof

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Module["postRun"]]=="function")Module["postRun"]=[Module["postRun"];while(Module["postRun"].length){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)function addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a pthread worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}}function removeRunDependency(id){runDependencies--;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDependencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}if(dependenciesFulfilled){var callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module["preloadedAudios"]={};function abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.error("Pthread aborting at "+(new Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the wasm failed"}}catch(err){abort(err)}}function getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at "+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)})}}else{if(readAsync){return new Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function receiveInstance(instance,module){var exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.loadWasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-instantiate")})})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}}function receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling

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back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))} else { return
instantiateArrayBuffer(receiveInstantiatedSource)} } if (Module["instantiateWasm"]) { try { var
exports=Module["instantiateWasm"](info, receiveInstance); return exports } catch (e) { err("Module.instantiateWasm
callback failed with error: "+e); return false } } instantiateAsync().catch(readyPromiseReject); return { } } var
ASM_CONSTS={ 10520:function(){throw"Canceled!"}, 10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback=="function"){callback(Module);continue}var func=callback.func;if(typeof
func=="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={ EPERM:63, ENOENT:44, ESRCH:71, EINTR:27, EIO:29, ENXIO:60, E2BIG:1, ENOEXEC:45, E
BADF:8, ECHILD:12, EAGAIN:6, EWOULDBLOCK:6, ENOMEM:48, EACCES:2, EFAULT:21, ENOTBLK:105, EB
USY:10, EEXIST:20, EXDEV:75, ENODEV:43, ENOTDIR:54, EISDIR:31, EINVAL:28, ENFILE:41, EMFILE:33, EN
OTTY:59, ETXTBSY:74, EFBIG:22, ENOSPC:51, EPIPE:70, EROFS:69, EMLINK:34, EPIPE:64, EDOM:18, ERAN
GE:68, ENOMSG:49, EIDRM:24, ECHRNG:106, EL2NSYNC:156, EL3HLT:107, EL3RST:108, ELNRNG:109, EUNA
TCH:110, ENOCSI:111, EL2HLT:112, EDEADLK:16, ENOLCK:46, EBADE:113, EBADR:114, EXFULL:115, ENOA
NO:104, EBADRQC:103, EBADSLT:102, EDEADLOCK:16, EBFONT:101, ENOSTR:100, ENODATA:116, ETIME:
117, ENOSR:118, ENONET:119, ENOPKG:120, EREMOTE:121, ENOLINK:47, EADV:122, ESRMNT:123, ECOMM
:124, EPROTO:65, EMULTIHOP:36, EDOTDOT:125, EBADMSG:9, ENOTUNIQ:126, EBADFD:127, EREMCHG:1
28, ELIBACC:129, ELIBBAD:130, ELIBSCN:131, ELIBMAX:132, ELIBEXEC:133, ENOSYS:52, ENOTEMPTY:55,
ENAMETOOLONG:37, ELOOP:32, EOPNOTSUPP:138, EPFNOSUPPORT:139, ECONNRESET:15, ENOBUFS:42,
EAFNOSUPPORT:5, EPROTOTYPE:67, ENOTSOCK:57, ENOPROTOOPT:50, ESHUTDOWN:140, ECONNREFU
SED:14, EADDRINUSE:3, ECONNABORTED:13, ENETUNREACH:40, ENETDOWN:38, ETIMEDOUT:73, EHOS
TDOWN:142, EHOSTUNREACH:23, EINPROGRESS:26, EALREADY:7, EDESTADDRREQ:17, EMSGSIZE:35, E
PROTONOSUPPORT:66, ESOCKTNOSUPPORT:137, EADDRNOTAVAIL:4, ENETRESET:39, EISCONN:30, EN
OTCONN:53, ETOOMANYREFS:141, EUSERS:136, EDQUOT:19, ESTALE:72, ENOTSUP:138, ENOMEDIUM:14
8, EILSEQ:25, EOVERFLOW:61, ECANCELED:11, ENOTRECOVERABLE:56, EOWNERDEAD:62, ESTRPIPE:13
5};function
__emscripten_futex_wake(addr, count) { if (addr <= 0 || addr > GROWABLE_HEAP_I8().length || addr & 3 != 0 || count < 0) retu
rn -28; if (count == 0) return 0; if (count >= 2147483647) count = Infinity; var
mainThreadWaitAddress = Atomics.load(GROWABLE_HEAP_I32(), __emscripten_main_thread_futex >> 2); var
mainThreadWoken = 0; if (mainThreadWaitAddress == addr) { var
loadedAddr = Atomics.compareExchange(GROWABLE_HEAP_I32(), __emscripten_main_thread_futex >> 2, mainTh
readWaitAddress, 0); if (loadedAddr == mainThreadWaitAddress) { --count; mainThreadWoken = 1; if (count <= 0) return
1 } } var ret = Atomics.notify(GROWABLE_HEAP_I32(), addr >> 2, count); if (ret >= 0) return
ret + mainThreadWoken; throw "Atomics.notify returned an unexpected value
"+ret } Module["_emscripten_futex_wake"] = __emscripten_futex_wake; function
killThread(pthread_ptr) { if (ENVIRONMENT_IS_PTHREAD) throw "Internal Error! killThread() can only ever be
called from main application thread!"; if (!pthread_ptr) throw "Internal Error! Null pthread_ptr in
killThread!"; GROWABLE_HEAP_I32()[pthread_ptr + 12 >> 2] = 0; var
pthread = PThread.pthreads[pthread_ptr]; pthread.worker.terminate(); PThread.freeThreadData(pthread); PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker), 1); pthread.worker.pthread = undefined } functio
n cancelThread(pthread_ptr) { if (ENVIRONMENT_IS_PTHREAD) throw "Internal Error! cancelThread() can only
ever be called from main application thread!"; if (!pthread_ptr) throw "Internal Error! Null pthread_ptr in
cancelThread!"; var
pthread = PThread.pthreads[pthread_ptr]; pthread.worker.postMessage({"cmd": "cancel"}) } function
cleanupThread(pthread_ptr) { if (ENVIRONMENT_IS_PTHREAD) throw "Internal Error! cleanupThread() can only
ever be called from main application thread!"; if (!pthread_ptr) throw "Internal Error! Null pthread_ptr in

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cleanupThread!";var
pthread=PThread pthreads[thread_ptr];if(pthread){GROWABLE_HEAP_I32()[thread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)} }var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb)},initWorker:function(){,t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread pthreads){var
pthread=PThread pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)} }PThre
ad pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread pthreads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker pthread)PThread.currentProxiedOperationCallerThread=worker pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+'\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d["thread"])}}else
if(cmd===\"killThread\"){killThread(d["thread"])}}else

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if(cmd===\cancelThread\"){cancelThread(d[\thread\])}else
if(cmd===\loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\print\"){out(\Thread \"+d[\threadId\"]+\":
\"+d[\text\])}else if(cmd===\printErr\"){err(\Thread \"+d[\threadId\"]+\": \"+d[\text\])}else
if(cmd===\alert\"){alert(\Thread \"+d[\threadId\"]+\": \"+d[\text\])}else if(cmd===\exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\exitProcess\"){try{exit(d[\returnCode\])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\setimmediate\"){worker.postMessage(e.data)}else{err(\worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\pthread sent
an error! \"+e.filename+\":\"+e.lineno+\":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\message\",function(data){worker.onmessage({data:d
ata})});worker.on(\error\",function(data){worker.onerror(data)});worker.on(\exit\",function(data){})}worker.post
Message({\"cmd\":\load\",\"urlOrBlob\":Module[\mainScriptUrlOrBlob\]|_scriptDir,\"wasmMemory\":wasmMe
memory,\"wasmModule\":wasmModule}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\tfjs-
backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\unknown filename],line,func?UTF8ToString(func):\unknown
function\")}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\hrtime\]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[__performance_now_clock_drift\]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\":\processQueuedMainThreadWork\})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\":\processThreadQueu
e\})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\":\processThreadQueue\})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\timed-out\")return-

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73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atoms.wait returned an unexpected value
\"+ret}else{if(Atoms.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atoms.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atoms.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retu
rn ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))}{return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList

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});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){ var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function

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findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ext["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcount){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)}}return 1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:

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ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined){webGLContextAttributes.enableExtensions
ByDefault}{GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined){JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===`\`){name=name.slice(0,name.lastIndexOf(``))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GLctx.getNewId(GLctx.uniforms);utable[name]=[u.size,id];GLctx.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+`\`+j+`\`;loc=GLctx.getUniformLocation(p,n);id=GLctx.getNewId(GLctx.uniforms);GLctx.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GLctx.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return

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_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j]);num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg))}}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! spawnThread()
can only ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`Internal
error!`;if(!threadParams.pthread_ptr)throw`Internal error, no pthread
ptr!`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;+i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","\start_routine":threadParams.startRoutine,"\arg":threadParams.arg,"\threadInfoStruct":thre
adParams.pthread_ptr,"\stackBase":threadParams.stackBase,"\stackSize":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`undefined`){err(`Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=`spawnThread`;postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var

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tb=_pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
_emsripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\)}function
__emsripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()===thread){err(\PThread
\'+thread+\'' is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emsripten_main_browser_thread_id()===thread){err(\Main thread
\'+thread+\'' is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!===thread){err(\pthread_join attempted on thread
\'+thread+\', which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\', which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emsripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage(\{\"cmd\":\`cleanupThread\`,`thread\":thread\});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emsripten_main_thre
ad_process_queued_calls();_emsripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function _pthread_join(thread,status){return __emsripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\`hardwareConcurrency\`]|1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emsripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emsripten_notify_thread_queue,\"b\":_abort,\"y\":
_emsripten_asm_const_int,\"j\":_emsripten_conditional_set_current_thread_status,\"d\":_emsripten_futex_wait,\"
c\":_emsripten_futex_wake,\"f\":_emsripten_get_now,\"p\":_emsripten_memcpy_big,\"A\":_emsripten_num_l
ogical_cores,\"u\":_emsripten_receive_on_main_thread_js,\"q\":_emsripten_resize_heap,\"v\":_emsripten_set_ca

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nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[
\"asm\"][\"S\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"U\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"V\"]).apply(null,arguments
)};var
_Cosh=Module[\"_Cosh\"]=function(){return(_Cosh=Module[\"_Cosh\"]=Module[\"asm\"][\"W\"]).apply(null,argu
ments)};var
_CropAndResize=Module[\"_CropAndResize\"]=function(){return(_CropAndResize=Module[\"_CropAndResize\"]
=Module[\"asm\"][\"X\"]).apply(null,arguments)};var

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_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_"_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"ra"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"sa"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ta"]).apply(null,arguments)};var

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_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\ua]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\va]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\wa]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\xa]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\ya]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\za]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][\Aa]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][\Ba]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][\Ca]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\Da]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\Ea]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\Fa]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\Ga]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\Ha]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\Ia]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\Ja]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\Ka]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][\La]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][\Ma]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][\Na]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][\Oa]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][\Pa]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][\Qa]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][\Ra]).apply(null,arguments)};var

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_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Sa"]);
apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ta"]);ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Ua"]);.apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Va"]);.a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Wa"]);.apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Xa"]);.apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"]["Ya"]);.apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Za"]);.apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"]["_a"]);.apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]);.apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]);.apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]);.apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]);.apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]);.apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]);.apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb
b"]);.apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb
b"]);.apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"]["hb"]);.apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]);.apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]);.apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"]["kb"]);.apply(null,arguments)};var
_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=function(){return(_emsripten_get_global
_libc=Module["_emsripten_get_global_libc"]=Module["asm"]["lb"]);.apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"]["mb"]);.apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]);.apply(null,arguments)};var

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_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=function(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=function(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"][["rb"]]).apply(null,arguments)};var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(null,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){return(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm"][["tb"]]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=Module["asm"][["ub"]]).apply(null,arguments)};var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsripten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Module["__emsripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][["zb"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"]]).apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=Module["asm"][["Bb"]]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"][["Cb"]]).apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=10512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module["ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromiseResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){return}function

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doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus\"])Module["setStatus\"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus\"]("\n"),1);doRun(),1)}else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit\"])Module["onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit\"])if(typeof
Module["preInit"]===\function\"){Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n);nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"] =
WasmBackendModuleThreadedSimd;\n", "\nvar WasmBackendModule = (function() {\n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=""";function
locateFile(path){if(Module["locateFile\"])return Module["locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\path\").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs");if(!nodePath)nodePath=require(\path");filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync\"](filename,binary?null:\utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,\^");arguments_=process["arg
v"].slice(2);process["on\"](\uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on\"](\unhandledRejection",abort);quit_=function(status){process["exit\"](status)};Module["insp
ect"]=function(){return["Emscripten Module object"]}"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,\binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof

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arguments!=="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}if(typeof print!=="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("\")+1)}else{scriptDirectory=""}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function

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UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;+i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function

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getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"} }catch(err){abort(err)} }function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\function\&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){if(!response[\ok\]){throw"failed to load wasm binary file at
\"+wasmBinaryFile+\"}return response[\arrayBuffer\]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\asm\]=exports;wasmMemory=Module[\asm\][\j\];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\asm\][\r\];removeRunDependency(\wasm-
instantiate\)}addRunDependency(\wasm-instantiate\);function
receiveInstantiatedSource(output){receiveInstance(output[\instance\])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\instantiateWasm\]){try{var
exports=Module[\instantiateWasm\](info,receiveInstance);return exports }catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false }}instantiateAsync().catch(Promise.reject);return{ }}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue }var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true }}return false }var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){var num=0;for(var

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i=0;i<iocvnt;i++){ var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _thread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]|1;return 1 } }setErrNo(28);return-1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var

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_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]["z"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["A"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]["B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["C"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]["T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]["U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"]["V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"]["W"]).apply(null,arguments)};var

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_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_X]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_Y]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_Z]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_$]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_aa]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_ba]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_ca]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_da]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_ea]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_fa]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_ga]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_ha]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_ia]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_ja]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_ka]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_la]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_ma]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_na]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_oa]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_pa]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_qa]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_ra]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_sa]).apply(null,arguments)};var

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_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"ta"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"Qa"]).apply(null,arguments)};var

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_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra
a")]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["Sa")]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["Ta")]).apply(nu
ll,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["Ua")]).apply(null,argument
s)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["Va")]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["Wa")]).
apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["Xa")]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ya"
]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);};\n\n\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n

```

```

this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:\n number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return\n this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =\n util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:\n DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n }\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *\n util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values\n as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\n this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n }\n this.dataIdMap.delete(dataId);\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():\n 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:\n false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this\n * method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated\n * elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:\n number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset\n == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =\n this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const\n {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new\n Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,\n size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n function\n createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n

```



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});\n });\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n
throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-
wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const ;\n\nconst
WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:
string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet
customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n * \n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*\n * export function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n
 '\n `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n * \n * \n * \n * setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * \n * tf.setBackend('wasm');\n *
\n * \n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n *
SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n *
full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located
in the same directory, or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional
boolean to use platform fetch to download\n * the wasm file, default to false.\n * \n * @doc {heading:
'Environment', namespace: 'wasm'}\n *\n * export function setWasmPaths(\n prefixOrFileMap: string|{\n [key in
WasmBinaryName]?: string\n },\n usePlatformFetch = false): void {\n if (initAborted) {\n throw new Error(\n
'The WASM backend was already initialized. Make sure you call ' +\n '\n `setWasmPaths()` before you call
`tf.setBackend()` or ' +\n '\n `tf.ready()`);\n }\n \n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix
= prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw new
Error(\n `There were no entries found for the following binaries: ` +\n ` ${missingPaths.join(',')}. Please
either call setWasmPaths with a ` +\n `map providing a path for each binary, or with a string indicating ` +\n
 `the directory where all the binaries can be found.`);\n }\n }\n \n customFetch = usePlatformFetch;\n}\n\n/**
Used in unit tests. *\n * export function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n
wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n * \n * This must be called before calling
`tf.setBackend('wasm')`.\n *\n * export function setThreadsCount(numThreads: number) {\n threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * \n * It is set after the
backend is intialized.\n *\n * export function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n
throw new Error(`WASM backend not initialized.`);\n }\n return actualThreadsCount;\n}\n\n",\nexport const
wasmWorkerContents = `var Module={};function threadPrintErr(){var
text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function threadAlert(){var
text=Array.prototype.slice.call(arguments).join("\n");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new

```

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WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
return instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\"load\"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===\"string\"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===\"objectTransfer\"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init\""](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace\""](top,max);Module["__emscripten_tls_init\""](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["__pthread_self
\"](),1);try{var
result=Module["invokeEntryPoint\""](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime\""]())Module["
PThread"].threadExit(result)}catch(ex){if(ex===\"Canceled!\"){Module["PThread"].threadCancel()}else
if(ex!==\"unwind\")if(ex instanceof
Module["ExitStatus\"]){if(Module["getNoExitRuntime\""]()){}}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw ex}}}}else
if(e.data.cmd===\"cancel\")if(Module["__pthread_self\""]()){Module["PThread"].threadCancel()}else
if(e.data.target===\"setimmediate\"){}else
if(e.data.cmd===\"processThreadQueue\")if(Module["__pthread_self\""]()){Module["__emscripten_current_thread_
process_queued_calls\""]()}else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href:__filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}}};\"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n\n const {wasm} = await init();\n\n return new
BackendWasm(wasm);\n\n}, WASM_PRIORITY);\n\n\"/** @license See the LICENSE file. *\n\n// This code is
auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport
{version};\n\n\"names\":[\"CppDType\", \"FusableActivation\", \"wasmFusedMatMul\", \"fusedMatMulConfig\", \"kernelNa
me\", \"_FusedMatMul\", \"backendName\", \"setupFunc\", \"backend\", \"wasm\", \"cwrap\", \"kernelFunc\", \"args\", \"inputs\", \"attrs\"

```

,"a","b","bias","preluActivationWeights","dtype","Error","transposeA","transposeB","activation","leakyreluAlpha",  
"aId","dataIdMap","get","dataId","id","bId","biasId","biasData","shape","length","preluActivationWeightsId","fuse  
dActivation","leftDim","rightDim","batchDim","out","makeOutput","outId","aShapeBytes","UInt8Array","Int32Arr  
ay","buffer","bShapeBytes","createUnaryKernelConfig","outType","wasmFunc","x","xId","util","sizeFromShape",  
absConfig","Abs","createBinaryKernelConfig","supportsFullBroadcast","outputType","newShape","backend\_util",  
assertAndGetBroadcastShape","aBroadcastDims","getBroadcastDims","bBroadcastDims","loopsOverAllOfA","eve  
ry","v","i","loopsOverAllOfB","addConfig","Add","addNConfig","AddN","inputIds","map","inputIdsBytes","identi  
ty","inVals","typedArrayFromHeap","set","identityConfig","Identity","wasmTranspose","transpose","reducedShape  
","perm","newPerm","push","minValIdx","j","removeOneSizeDims","permIsNoOp","outShape","inShape","Array",  
"computeOutShape","cloned","permBytes","xShapeBytes","transposeConfig","Transpose","permuteAxesAndTrans  
pose","axis","xShape","xRank","originalAxes","parseAxisParam","axes","permutedAxes","getAxesPermutation","x  
Transposed","inputWasTransposed","getInnerMostAxes","transposed","wasmAll","allConfig","All","keepDims","i  
nputId","input","inputRank","assertAxesAreInnerMostDims","reduceShape","computeOutAndReduceShapes","redu  
ceSize","disposeData","expandShapeToKeepDim","wasmAny","anyConfig","Any","argMaxConfig","ArgMax","tra  
nsposedId","slice","outerSize","innerSize","wasmAvgPool","avgPoolConfig","AvgPool","filterSize","strides","pad  
","dimRoundingMode","convInfo","computePool2DInfo","filterHeight","filterWidth","padTop","padInfo","top","pad  
Right","right","padBottom","bottom","padLeft","left","strideHeight","strideWidth","channels","inChannels","dataF  
ormat","dilationWidth","dilationHeight","reshape","xSize","\$shape","inferFromImplicitShape","assert","incRef","re  
shapeConfig","Reshape","wasmBatchMatMul","batchMatMulConfig","BatchMatMul","aRank","bRank","innerSha  
peA","innerShapeB","outerShapeA","outerShapeB","outerDimsA","outerDimsB","batchDimA","batchDimB","batc  
hDimsCompatible","concat","b3dShape","a3d","b3d","a3dId","b3dId","Math","max","sliceImpl","vals","begin","siz  
e","isContinous","slice\_util","isSliceContinous","xStrides","computeStrides","flatOffset","computeFlatOffset","sub  
array","decodedData","fromUInt8ToStringArray","inBuf","outBuf","outLoc","indexToLoc","inLoc","idx","fromStri  
ngArrayToUInt8","values","begin\_","size\_","parseSliceParams","xVals","readSync","outData","stringBytes","res",  
sliceImplCPU","outVals","rank","xStride","outOffset","beginI","beginJ","endI","xOffset","slice2d","xStride1","xStr  
ide2","beginK","endJ","slice3d","xStride3","endK","beginL","k","slice4d","sliceConfig","Slice","batchToSpaceND  
Config","BatchToSpaceND","blockShape","crops","prod","reduce","reshaped","getReshaped","permuted","getPerm  
uted","reshapedPermuted","getReshapedPermuted","sliceBeginCoords","getSliceBeginCoords","sliceSize","getSlic  
eSize","xReshaped","result","cast","castConfig","Cast","ceilConfig","Ceil","wasmClip","clipByValueConfig","Clip  
ByValue","clipValueMin","clipValueMax","t","\$inputs","filter","shapes","assertParamsConsistent","inputs2D","inp  
utsValShapes","simplyConcat","getArrayFromDType","offset","forEach","colOffset","tIdx","row","resIdx","col","c  
oncatImplCPU","finalOutShape","sumInnerDims","innerDims","innerDim","inOffset","concatConfig","Concat","w  
asmConv2d","conv2DConfig","Conv2D","filterId","dilations","\$dataFormat","convertConv2DDataFormat","compu  
teConv2DInfo","inputChannels","outputChannels","outChannels","isSamePad","type","wasmConv2DBackpropInpu  
t","conv2DBackpropInputConfig","Conv2DBackpropInput","dy","inputShape","batchSize","inHeight","inWidth",  
outHeight","outWidth","topPad","leftPad","isChannelsLast","dxStrides","dyStrides","fltS0","fltS1","fltS2","xBatch  
Stride","xRowStride","xColStride","xChannelStride","yBatchStride","yRowStride","yColStride","yChannelStride",  
"dyId","cosConfig","Cos","coshConfig","Cosh","InterpolationMethod","wasmCropAndResize","cropAndResizeCo  
nfig","CropAndResize","method","extrapolationValue","cropSize","image","boxes","boxInd","numBoxes","cropHe  
ight","cropWidth","castedData","imagesData","imagesId","boxesId","boxIndId","imagesShapeBytes","wasmCumsu  
m","cumsumConfig","Cumsum","exclusive","reverse","permutation","permutedX","permutedAxis","permutedOut",  
"finalDim","permutedXId","permutedOutId","getUndoAxesPermutation","wasmDepthToSpace","depthToSpaceCo  
nfig","DepthToSpace","blockSize","outputHeight","outputWidth","outputDepth","outputShape","xStridesBytes","o  
utputShapeBytes","outStridesBytes","wasmDepthwiseConv2d","depthwiseConv2dNativeConfig","DepthwiseConv2  
dNative","\$dilations","eluConfig","Elu","equalConfig","Equal","expConfig","Exp","expandDims","dim","\$dim","s  
plice","expandDimsConfig","ExpandDims","fill","value","fillConfig","Fill","wasmFlipLeftRight","flipLeftRightCo  
nfig","FlipLeftRight","imageId","batch","imageHeight","imageWidth","numChannels","floorConfig","Floor","floor  
DivConfig","FloorDiv","wasmBatchNorm","fusedBatchNormConfig","FusedBatchNorm","varianceEpsilon","mean

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+U,OAACA,EAAMC,mBAAEA,EA AKBC,SAAEA,GAAY/U,GACzCgV,MAACA,EA AKC,MAAEA,EA AKC,O









CIE2I,EAAUnM,WAGN7N,EAAMhC,EAAQic,WAAWsa,EAAoB5Z,EAAEhC,OACrD,GAAoC,IAAhCkC,OAA KC,cAAcH,EAAEIB,OACvB,OAAOO,EAET,MAAMwa,EAACl,EAAS1a,MAAMC,OAAS,EAGtCkB,EADQ5C, EAAQkB,UAAUC,IAAIgb,EAAS/a,QAC3BC,GAGZia,EADctb,EAAQkB,UAAUC,IAAImb,EAAalb,QACzBC,G AExBa,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAE1CkW,EAAGb,IAAIInV,WACtB,IAAIC,WAA WQ,OAAKsJ,eAAegQ,EAAS1a,QAAQa,QACIDmV,EAakB,IAAIrV,WACxB,IAAIC,WAAWQ,OAAKsJ,eAAeo Q,IAAqBja,QAW5D,OATAkZ,GACI5Y,EAAKpD,EAASmD,EAAEhC,OAAQ4W,EAAeiF,EAAalB,EACpDU,E AAU3I,UAAWoE,EAAiBvV,GAE1CIC,EAAQuH,YAAY4U,EAAS/a,QAC7BpB,EAAQuH,YAAY+U,EAAalb,Q AGjCY,EAAIP,MAAQua,EAAUIE,YACftV,IC5FIya,GACTxZ,EAAyByZ,WAFC,EAE+B,QCDhDC,GACT1Z,E AAyB2Z,gBAFC,EAEoC,QCCIE,IAAIla,GA+BG,MAAMma,GAAgC,CAC3Cjd,WAAykd,YACZhd,YAAa,iBA9 Bf,SAAMBE,GACjB0C,GAAW1C,EAAQC,KAAKC,MAAM4c,YAAW,KAAiB,CACxD,SACA,SACA,SACA,Y A2BF3c,oBAAtBEC,GAGF,MAAOC,QAAQsC,EAACA,GAAlrC,OAAOyc,MAACA,GAAM/c,QAAEA,GAAWI,E AEzCwC,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAAEvB,QAAQC,GAGtCW,EAAMhC,EAAQic,WAAWU,EA AEIB,MAAO,WAExC,GAAoC,IAAhCoB,OAAKC,cAAcH,EAAEIB,OAAc,CACrC,MAAMS,EAAQIC,EAAQkB ,UAAUC,IAAIa,EAAIZ,QAAQC,GACHdQb,GAASE,EAAKpD,EAASmD,EAAEhC,OAAQoc,EAAO7a,GAG1C, OAAOF,IC/BIgb,GACT/Z,EAAyBga,QAFc,EAE4B,QCA7CC,GACTja,EAAyBka,aAFC,EAEiC,QCHIDC,GAA0 B5a,EAAWb6a,OCIDC,GACTra,EAAyBsa,cAFC,EAekC,QCGhE,IAAIC,GAwDG,MAAMC,GAA0B,CACrC7d ,WAAy8d,MACZ5d,YAAa,OACbC,UAXDF,SAAeC,GACbwd,GAAUxd,EAAQC,KAAKC,MAAMwd,MAAK,K AAe,CAC/C,SACA,SACA,SACA,YAoDFvd,WAhDF,SAAaC,GAEX,MAAMJ,QAACA,EAAOK,OAAEA,EAA MC,MAAEA,GAASF,GAC1Bud,iBAAkB3X,EAAIe,SAAEA,GAAYzG,GACrCqC,EAACA,GAAKtC,EAEZ,IAA I2G,EADQhH,EAAQkB,UAAUC,IAAIwB,EAAEvB,QAAQC,GAExC4F,EAAQte,EAEZ,MAAMgE,WAACA,E AAUN,KAAEA,EAAIF,aAAEA,EAAyM,mBAAEA,GACnCV,EAAwBpD,EAAGqD,EAAMhG,GAErC,GAAlYg ,EAAoB,CAEtBQ,EAAQN,EACRK,EAfQbHh,EAAQkB,UAAUC,IAAIwF,EAAWvF,QAAQC,GAKhE,MAAM6 F,EAAYD,EAAMxF,MAAMC,OAC9B2B,eAAa8D,2BAA2B,MAAOd,EAAMa,GACrD,MAAO5B,EAAU8B,GA Cb/D,eAAagE,0BAA0BJ,EAAMxF,MAAO4E,GACIDiB,EAAazE,OAAKC,cAAcE,GAehCpF,EAAMhC,EAAQi C,WAAWqD,EAAU3C,EAAEhC,OAC3C,GAAwC,IAApCkC,OAAKC,cAAcmE,EAAMxF,OAAc,CACzC,MAA MS,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GACHdmc,GAAQxW,EAASxH,EAASmD,EAAEhC,O AAQ2G,EAAyPf,GAQID,GALluE,GAEFzG,EAAQuH,YAAYZ,EAAWvF,QAG7B2F,EAAU,CAEZ,MAAM3D, EAAWC,eAAamE,qBAAqBxF,EAAIP,MAAO0E,GAC9DnE,EAAIP,MAAQ2B,EAGd,OAAOpB,ICzDI4b,GACT 3a,EAAyB4a,WAFC,GCE9B,IAAIC,GAkFG,MAAMC,GAA8B,CACzCne,WAAyoe,UACZle,YAAa,OACbC,UA 9EF,SAAeC,GACb8d,GAac9d,EAAQC,KAAKC,MAAM8d,UAAAS,KAAiB,CACzD,SACA,SACA,SACA,SACA, SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA, YA6DF7d,WAZDF,SACIC, GACF,MAAMC,OAACA,EAAMC,MAAEA,EAANK,QAAEA,GAAWI,EAE3BuC,EAAItC,EAAOsC,EACXC,E AAM5C,EAAQkB,UAAUC,IAAIwB,EAAEvB,QAAQC,GAU5CwB,OAAKoH,OACW,YAAZtH,EAAEhC,OAC F,IACI,0DAA0DgC,EAAEhC,WAEpE,MAAM0H,WAACA,EAAUC,QAAEA,EAAOC,IAAEA,EAAGC,gBAAE A,GAAMbII,EAC9CmI,EAAWpF,eAAaqF,kBAC1B/F,EAAEIB,MAAO4G,EAAYC,EAAS,EAAMBC,EAAKC,G AEpDG,EAAeF,EAASE,aACxBC,EAAcH,EAASG,YACvBC,EAASJ,EAASK,QAAQC,IAC1BC,EAAWP,EAAS K,QAAQG,MAC5BC,EAAYT,EAASK,QAAQK,OAC7BC,EAAUX,EAASK,QAAQO,KAC3BO,EAAiBnB,EAA SmB,eAC1BD,EAAGBIB,EAASKB,cACzBL,EAAeb,EAASa,aACxBC,EAAcd,EAASc,YACvBoJ,EAAGBIK,EAA SgB,WACzBmJ,EAAiBnK,EAASoK,YAEhC,GAA4B,iBAAXBpK,EAASiB,WACX,MAAM,IAAI9I,MAEN,6CA AG6H,EAASiB,2CAGIB,MAAM1H,EAAMhC,EAAQic,WAAWwG,EAASnD,SAAU,WAC5CpD,EAAQIC,EAA QkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAMhD,OAJAyc,GACIib,EAAKD,EAAEIB,MAAM,GAAlkB,EAAEIB,M AAM,GAAlkB,EAAEIB,MAAM,GAAlkH,EAAcC,EACvDC,EAAQG,EAAUE,EAWE,EAASQ,EAAGBD,EACt DL,EAAcC,EAAaoJ,EAAeC,EAAGB1Q,GACvDF,IC5ET,IAAIic,GAqEG,MAAMC,GAA2B,CACtCte,WAAyue, OACZre,YAAa,OACbC,UAtEF,SAAeC,GACbie,GACIje,EAAQC,KAAKC,MAAMie,OAAM,KAAe,CAAC,4BA qE7Che,oBAjEEC,GAEF,MAAMJ,QAACA,EAAOK,OAAEA,EAAMC,MAAEA,GAASF,GAC3B4F,KAACA,E AAIE,SAAEA,GAAYzG,GACnBqC,EAACA,GAAKtC,EACNuC,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAAEv B,QAAQC,GAC5C,IAAI2F,EAUpE,EACVqE,EAAQtE,EAEZ,MAAMgE,WAACA,EAAUN,KAAEA,EAAIF,a AAEA,EAAyM,mBAAEA,GACnCV,EAAwBpD,EAAGqD,EAAMhG,GAErC,IAAIoe,EAAGB/X,EACpB,GAAlI

,EAAoB,CACtB,MAAMqB,EAAe9H,EAAQkB,UAAUC,IAAIwF,EAAWvF,QAAQC,GAC1DyG,IAAiBIF,IAGnBqE,EAAQN,EACRK,EAAUc,EACVsW,EAAGb/a,eAAaqD,iBACzB0X,EAAC1c,OAAQuF,EAAMxF,MAAMC,SAI1C2B,eAAa8D,2BACT,OAAQiX,EAAenX,EAAMxF,MAAMC,QACvC,MAAO4D,EAAU8B,GACb/D,eAAAgE,0BAA0BJ,EAAMxF,MAAO2c,GACID9W,EAAazE,OAAKC,cAAcsE,GACtC,IAAliX,EAACPX,EACE,YAAhBA,EAAMtG,QACR0d,EACIpO,EAAK,CAACjQ,QAAAA,EAASK,OAAQ,CAACsC,EAAGsE,GAAQ3G,MAAO,CAACK,MAAO,aACtDqG,EAAUhH,EAAQkB,UAAUC,IAAIkd,EAAyjD,QAAQC,IAGtD,MAAMW,EAAMhC,EAAQiC,WAAWqD,EAAU,WACzC,GAAwC,IAApCzC,OAAKC,cAAcmE,EAAMxF,OAAc,CACzC,MAAMS,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GACHd4c,GAASjX,EAASM,EAAypF,GAQhC,GALiUE,GAEFzG,EAAQuH,YAAyz,EAAWvF,QAG7B2F,EAAU,CAEZ,MAAM3D,EAAWC,eAAamE,qBAAqBxF,EAAIP,MAAO0E,GAC9DnE,EAAIP,MAAQ2B,EAOD,MAJoB,YAAhB6D,EAAMtG,OACRX,EAAQuH,YAAy8W,EAAyjD,QAG3BY,ICIET,IAAIsc,GA6DG,MAAMC,GAA0B,CACrC3e,WAAY4e,MACZ1e,YAAa,OACbC,UA7DF,SAAeC,GACbse,GAAUte,EAAQC,KAAKC,MAAMse,MAAK,KAAe,CAC/C,SACA,SACA,SACA,YAyDFre,WArDF,SAAaC,GAEX,MAAMJ,QAACA,EAAOK,OAAEA,EAAMC,MAAEA,GAASF,GAC3B4F,KAACA,EAAIe,SAAEA,GAAyzG,GACnBqC,EAACA,GAAKtC,EACNuC,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAAEvB,QAQC,GAC5C,IAAI2F,EAAUpE,EACVqE,EAAQtE,EAEZ,MAAMgE,WAACA,EAAUN,KAAEA,EAAIF,aAAEA,EAAyM,mBAAEA,GACnCV,EAAwBpD,EAAGqD,EAAMhG,GAErC,GAAIyG,EAAoB,CACtB,MAAMqB,EA Ae9H,EAAQkB,UAAUC,IAAIwF,EAAWvF,QAAQC,GAC1DyG,IAAiBIF,IAGnBqE,EAAQN,EACRK,EAAUc,GAId,MAAMZ,EAAyD,EAAMxF,MAAMC,OAE9B2B,eAAa8D,2BAA2B,MAAOd,EAAMa,GACrD,MAAO5B,EAAU8B,GACb/D,eAAAgE,0BAA0BJ,EAAMxF,MAAO4E,GACIDiB,EAAazE,OAAKC,cAAcsE,GAehCpF,EAAMhC,EAAQiC,WAAWqD,EAAU2B,EAAMtG,OAC/C,GAAwC,IAApCkC,OAAKC,cAAcmE,EAAMxF,OAAc,CACzC,MAAMS,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GACHdid,GAAQtX,EAASxH,EAASmD,EAAehC,OAAQ2G,EAAypF,GAQID,GALiUE,GAEFzG,EAAQuH,YAAyz,EAAWvF,QAG7B2F,EAAU,CAEZ,MAAM3D,EAAWC,eAAamE,qBAAqBxF,EAAIP,MAAO0E,GAC9DnE,EAAIP,MAAQ2B,EAGd,OAAOpB,IC9DIyc,GACTxb,EAAyByb,WAFc,GCK9B,IAAKC,GAKL,IAAIC,IALJ,SAAKD,GACHA,yBACAA,6BAFF,CAA KA,KAAAA,QakDE,MAAME,GAAGc,CAC3Cjf,WAAYkf,YACZhf,YAAa,OACbK,WA9BF,SAAmBC,GAKjB,MAAOC,QAAQsC,EAACA,GAAE3C,QAAEA,EAASM,OAAOye,SAACA,EAAQC,KAAEA,IAAS5e,EAEIDkF,EAAWyZ,EAAS3a,KACtB,CAAC6a,EAAGpb,IAAMob,EAAE,GAAqBtc,EAAEIB,MAAMoC,GAAKob,EAAE,KAC9Crc,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAAEvB,QAAQC,GACtCW,EAAMhC,EAAQiC,WAAWqD,EAAU3C,EAAehC,OACrCuB,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAC1CuE,EAAc,IAAIxD,WA AW,IAAIC,WAAWM,EAAEIB,OAAOa,QAERd4c,EAakBH,EAAS3a,KAAI+a,GAAYA,EAAS,KACpDC,EAAM BL,EAAS3a,KAAI+a,GAAYA,EAAS,KACrDE,EACF,IAAIjd,WAAW,IAAIC,WAAW6c,GAAiB5c,QAC7Cgd,E ACF,IAAIld,WAAW,IAAIC,WAAW+c,GAakB9c,QAKpD,OAHAsc,GACIhc,EAAKGD,EAAajD,EAAEIB,MAA MC,OAAQIC,EAASmD,EAAehC,OAAQ0e,EACrDC,EAAMBX,GAakBK,GAAO9c,GACzCF,GAOPjC,UA5CF, SAAeC,GACb4e,GAAGb5e,EAAQC,KAAKC,MAAM4e,YAAW,KAAiB,CAC7D,SACA,QACA,SACA,SACA,Q ACA,QACA,SACA,aCrBSS,GACTtc,EAAyBuc,YAFc,GCFjBC,GAA0Bjd,EAAwBkd,gBCW/CC,GACZ3f,EAAS B4f,GACxB,MAAM5P,EAAS,IAAI3N,WAAWrc,EAAQC,KAAK4f,OAAOvd,OAAQsd,EAAW,GAC/DE,EAAM B9P,EAAO,GAC1B+P,EAAe/P,EAAO,GACtBgQ,EAakBhQ,EAAO,GACzBiQ,EAAgBjQ,EAAO,GAG7B,OAD AhQ,EAAQC,KAAKigB,MAAMN,GACZ,CAACE,iBAAAA,EAakBC,aAAAA,EAACc,gBAAAA,EAAiBC,cAA AA,GChB3D,IAAIvd,GA6CG,MAAMyd,GAA0C,CACrDvgB,WAAywgB,sBACZtgB,YAAa,OACbC,UA5CF,S AAeC,GACb0C,GAAW1C,EAAQC,KAAKC,MACpBkgB,sBACA,SACA,CACE,SACA,SACA,SACA,SACA,YA oCNjgB,WAhCF,SAAoBC,GAKIB,MAAMJ,QAACA,EAAOK,OAAEA,EAAMC,MAAEA,GAASF,GAC3BigB,a AACA,EAAyC,cAAEA,EAAaC,eAAEA,GAakBjgB,GACHdiV,MAACA,EAakIL,OAAEA,GAAUngB,EAEIB0 V,EAAU/V,EAAQkB,UAAUC,IAAIoU,EAAMnU,QAAQC,GAC9Cof,EAAWzgB,EAAQkB,UAAUC,IAAIqf,EA AOpf,QAAQC,GAehDue,EACfId,GAASqT,EAAS0K,EAAUH,EAAeD,EAAcE,IAEvDT,iBAACA,EAAgBC,aA AEA,EAAyC,gBAAEA,EAAeC,cAAEA,GACpDN,GAakB3f,EAAS4f,GAS/B,OANA5f,EAAQC,KAAKigB,MA AMF,GACnBhgB,EAAQC,KAAKigB,MAAMD,GAGfjgB,EAAQiC,WAAW,CAAC8d,GAAe,QAASD,KCxCID,IA AIpd,GakDG,MAAMge,GAA0C,CACrD9gB,WAAy+gB,sBACZ7gB,YAAa,OACbC,UhDF,SAAeC,GACb0C ,GAAW1C,EAAQC,KAAKC,MACpBygB,sBACA,SACA,CACE,SACA,SACA,SACA,SACA,SACA,SACA,UAuCNxgB,

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AIC,EAA SF,EA AWT,EA AOS,EA AOC,EA AgB,EA AU1yB,EA AE,EA AEA,EA AE2wB,EA AI9yB,SA ASmC,EA AE,CA AC,IA AI4yB,EA AEjC,EA AIkC,WAA W7yB,GAA Of,GAA 9E4yB,GA AG,OAA OA,GA AG,QA AkCA,EA AE,QAA U,KAA FA,IA AS,IA AO,KAA 9CjC,EA AIkC,aAA a7yB,IA AqC4yB,GA AG,IA AI,CA AC,GA AGH,GAA QT,EA AO,MA AMF,EA AKW,KAA UG,OAA O,GA AGA,GA AG,KA AK,CA AC,GA AGH,EA AO,GA AGT,EA AO,MA AMF,EA AKW,KAA U,IA AI,GA AG,EA AE,EA AKW,KAA U,IA AM,GA AFG,OAA U,GA AGA,GA AG,MA AM,CA AC,GA AGH,EA AO,GA AGT,EA AO,MA AMF,EA AKW,KAA U,IA AI,GA AG,EA AE,GA AGd,EA AKW,KAA U,IA AM,GA AFG,MA AS,CA AC,GA AGH,EA AO,GA AGT,EA AO,MA AMF,EA AKW,KAA U,IA AI,GA AG,GA AGd,EA AKW,KAA U,IA AI,GA AG,GA AGd,EA AKW,KAA U,IA AI,GA AG,EA AE,GA AGd,EA AKW,KAA U,IA AM,GA AFG,GAA qB,OAA fd,EA AKW,GAA Q,EA ASA,EA AO,E,EA AS,SA AS9B,EA AaF,EA AI mC,EA AOJ,GAA iB,OAA OF,EA AkB7B,EA AI pG,IA AmBuI,EA AOJ,GAA iB,SA ASK,EA AgBpC,GAA e,IA AV,IA AI C,EA AI,EA AU5wB,EA AE,EA AEA,EA AE2wB,EA AI9yB,SA ASmC,EA AE,CA AC,IA AI4yB,EA AEjC,EA AIkC,WAA W7yB,GA AM4yB,GA AG,OAA OA,GA AG,QA AMA,EA AE,QAA U,KAA FA,IA AS,IA AwB,KAA pBjC,EA AIkC,aAA a7yB,IA AW4yB,GA AG,MA AMhC,EA AoBA,GA ARgC,GA AG,KAA U,EA AU,GA AG,MA AW,EA AY,EA AE,OAA OhC,EA AI,SA ASK,GA AmBF,EA AMtyB,GAA Q0rB,IA AmBvpB,IA AI mwB,EA AMtyB,GAA Q,SA ASu0B,GAA Ql0B,EA AE m0B,GA AkD,OAA rCn0B,EA AE m0B,EA AS,IA AGn0B,GA AGm0B,EA ASn0B,EA AE m0B,GA AgBn0B,EA AwE,SA ASurB,GAA 2B6I,GA AKz0B,EA AOy0B,EA III,E AAc,MA AEV,EA AM,IA AI6I,UAA UD,GA AKII,EA Ae,OA AS,IA AIoI,WAA WF,GA AKII,EA Ae,OAA EP,EA AO,IA AIjsB,WAA W00B,GA AKII,EA Ae,OAA EhP,EA AO,IA AIzd,WAA W20B,GA AKII,EA AgB,QAA U,IA AIqI,YAA YH,GA AKII,EA AgB,QAA EL,EA AQ,IA AI2I,YAA YJ,GA AKII,EA AgB,QAA U,IA AIuI,aAA aL,GA AKII,EA AgB,QAA EH,EA AQ,IA AI2I,aAA aN,GA AK,IA Au3BO,GA An3BC,GAA eI,EA AuB,gBA AG,SA AS,GA AGmB,EA AwB/B,EA AWY,EA AmB,WAA EvsB,EA AOusB,EA Ae,YAA O,GA AGA,EA AmB,WA AGZ,EA AWY,EA AmB,gBAA oH,MA A7GZ,EA AW,IA AI d,YAA YqK,OAA O,CA ACC,QAA UF,GAA e,MA AMG,QAA U,MA AiBC,QA AS,KAA uBr1B,kBA AkBkrB,mBA AgZ,MA A5XgG,EA AI,+NA AKO/D,GAA Qb6B,QAA QW,IA AI,qHAA2HrxB,MA AM,c AAmBqtB,IA AY3rB,EA AO2rB,EA AW3rB,QAA Oi1B,GA Ae j1B,EA AO s1B,WAA W1J,GAA 2B5rB,GA ASB,IA AI u1B,GAA a,GAA OC,GA AW,GAA OC,GA AW,GA AyBC,GAA c,GAA 4I,SA ASC,KA AS,IA AGjI,EA AH,CA AiC,G AAGnB,EA Ae,OAA 8E,IA A/C,mBA AI BA,EA Ae,SA AcA,EA Ae,OAA E,CA ACA,EA Ae,SA ASA,EA Ae,OAA EntB,QAA Qw2B,GA AYrJ,EA Ae,OAA EsJ,SAA UC,GAA qBP,KAA c,SA ASQ,KAA yCrI,GAA 8BoI,GAA qBN,IA AY,S AASQ,KAA aI,GAA 8BoI,GAA qBL,IA AuF,SA ASQ,KAA U,IA AGvI,EA AH,CA AiC,GAA GnB,EA AgB,QAA iF,IA AjD,mBA AnBA,EA AgB,UA AcA,EA AgB,QAA E,CA ACA,EA AgB,UA ASA,EA AgB,QAA EntB,QAA Q82B,GAA a3J,EA AgB,QAA EsJ,SAA UC,GAA qBJ,KAA e,SA ASE,GA AYO,GA AIZ,GAA a,QAA QD,GA AI,SA ASD,GAA aC,GA AIT,GAA cU,QAA QD,GA Ap8BzI,GA AuB8H,GA AW7yB,KA AK,CA ACgvB,KA AK,WAA W0E,QA Ag5B,IA AIC,GA AgB,EA AoCC,GA ASB,KA AK,SA ASC,GAA iBz3B,GAA I4I,GAA Q+IB,EA AuB,uDA AuD4I,KAA qB/J,EA A+B,wBA AGA,EA A+B,uBA AE+J,IA AkB,SA ASG,GAA oB13B,GAA 6G,GA AzGu3B,KAA qB/J,EA A+B,wBA AGA,EA A+B,uBA AE+J,IA AqC,GAA jBA,IA AqHC,GA ASB,CA AC,IA AI,GA AGH,GA ASBA,GA ASB,KA AKG,KAA uE,SA AS5H,GA AM6H,GA ASpK,EA AgB,SA AGA,EA AgB,QAA EoK,GA ASjJ,GA AuBsB,QAA QC,MA AM,wBA AuB,IA AK3wB,OAA Oo0B,OAA GBxB,EA ATyF,GA AM,IA AnF,GA AM,EA AkBmF,EA AK,SA ASA,EA AK,+CAA +C,IA AIxS,EA AE,IA AI0G,YAA Y+L,aAA aD,GAA 4B,MA AtBrK,EA AmBnI,GA ASA,EA AE,SA AS0S,GA AU3E,EA AI4E,GAA Q,OAA OnD,OAA OoD,UAA UC,WAA W9E,EA AI8E,WAA WF,GAA 8B,IA AtB5E,EA AIjC,Q AAQ6G,GAA xevK,EA AwB,gBA AE,GA AGA,EA AwB,gBA AE,GAA 6b,IA AI0K,GAA c,wCA AwC,SA ASC,GAA U3I,GAA U,OAA OsI,GAA UtI,EA AS0I,IA Ae,IA AIE,GAA c,UAA U,SA ASC,GAA U7I,GAA U,OAA OsI,GAA UtI,EA AS4I,IA Ae,IA AIE,GAA e,uCA AgH,SA ASC,GAA UC,GA AM,IA AI,GA AGA,GA AMF,IA AgBrG,EA AY,OAA O,IA AIx B,WAA Wkx B,GA AY,GA AGnD,EA AY,OAA OA,EA AW0J,GA AW,KA AK,kDA AmD,MA AMrG,GA AKpC,GA AMoC,IA AM,SA ASsG,KAA mB,IA AIxG,IA Aa/D,GAA oBC,GAA uB,CA AC,GA AkB,mBA ARuK,QAA qBL,GAA UC,IA AiB,OAA OI,MA AMJ,GAA e,CA ACK,YAA Y,gBA AgBC,MA AK,SA ASHh,GAA U,IA AIA,EA Aa,GA AG,KA AK,uCA AuC0G,GAA e,IA AI,OAA OIG,EA ASB,iBA AMiH,OA AM,WAA W,OAA ON,GAA UD,OA AuB,G AAGzJ,EA AW,OAA O,IA AIpB,SAA Q,SA ASC,EA AQc,GAA QkB,EA AUyJ,IA Ae,SA ASIG,GAA UIE,EA AQ,IA AI3sB,WAA W6wB,MA AYjE,MA AY,OAA OF,QAA QC,UAA UKL,MA AK,WAA W,OAA OL,GAA UD,OA AkB,S AASQ,KAA a,IA AI C,EA AK,CA AC75B,EA AI85B,IA Ae,SA ASC,EA AgBC,EA ASC,GAA Q,IA AI C,EA AQF,EA A

SE,QAA6E,GAAR5L,EAAY,IAAE4L,EAAQnD,GAAUzI,EAAY,IAAK,EAAE+E,EAAW4G,GAAWxK,EAAuB,CAAC,IAAI0K,EAaiBC,GAAQC,cAAcl5B,OAAOi5B,GAAQC,cAAcypB,SAAQ,SAASwpB,GAAGF,GAAQG,uBAAuBD,GAAE,aAAiBH,GAAiB3B,YAA8G,SAASgC,EAA0BC,GAAQV,EAAGBU,EAaiB,SAAEA,EAae,QAAG,SAASC,EAAuBC,GAAU,OAAOpB,KAAmBG,MAAK,SAASnJ,GAAQ,OAAO3D,YAAyGo,YAAyRk,EAAOsJ,MAAQH,KAAKiB,GAAS,SAASE,GAAQ5H,EAAl,0CAA0C4H,GAAQhK,GAAMgK,MAAomB,GAAP+BpL,GAAwB8I,KAA+8BjK,EAAwB,gBAAG,IAAgE,OAahDA,EAAwB,gBAAEuL,EAAKE,GAAGC,MAAM7T,GAAGe,OAA7D+M,EAAl,sDAAsD/M,IAAU,EAAoD,OAAxyB6M,GAAsD,mBAAnCnG,YAAyko,sBAAoC7B,GA AUG,KAAkBD,GAAUC,KAAgC,mBAARI,MAAsYkB,EAuBF,GAAlYhB,MAAMJ,GAae,CAACK,YAAy,gBAAgBC,MAAK,SAAShH,GAAGe,OAahD9F,YAAyko,qBAAqBpI,EAASmH,GAAoBH,KAAKc,GAA0B,SAASK,GAAuG,OAA/F5H,EAAl,kCAAKC4H,GAAQ5H,EAAl,6CAAoDyH,EAuBF,UAAkTb,MAAMtL,GAA0B,GAA3hF4K,GAAUG,MAAiBA,GAAepJ,EAWoJ,KAAy+E,IAAI2B,GAAW,CAACC,MAAM,WAAW,KAAK,aAAaC,MAAM,SAASC,EAAGC,GAAIC,YAAW,WAAWC,GAAMCH,EAAGC,KAAK,KAAK,SAASG,KAAiBIB,GAAQtC,cAAc,SAASD,GAAqB0D,GAAW,KAAMA,EAUp6B,OAAO,GAAE,CAAC,IAAI3B,EAAS8C,EAAU3D,QAAQ,GAAoB,mBAAVa,EAAV,CAA0D,IAAI/E,EAAK+E,EAAS/E,KAAsB,iBAAPA,OAAmCnG,IAAfKL,EAAS+C,IAAiBzE,GAAUn2B,IAAI8yB,EAAdqD,GAA2BA,GAAUn2B,IAAI8yB,EAAdqD,CAAoB0B,EAAS+C,KAAW9H,OAAoBnG,IAAfKL,EAAS+C,IAAgB,KAAK/C,EAAS+C,UAAxN/C,EAASnK,IAAsN,IAAIImN,GAAy,CAACC,MAAM,GAAGC,OAAO,GAAGC,MAAM,GAAGC,MAAM,GAAGC,IAAI,GAAGC,MAAM,GAAGC,MAAM,EAaec,QAAQ,GAAGC,MAAM,EAaec,OAAO,GAAGC,OAAO,EAaec,YAAy,EAaec,OAAO,GAAGC,OAAO,EAaec,OAAO,GAAGC,QAAQ,IAAIC,MAAM,GAAGC,OAAO,GAAGC,MAAM,GAAGC,OAAO,GAAGC,QAAQ,GAAGC,OAAO,GAAGC,OAAO,GAAGC,OAAO,GAAGC,OAAO,GAAGC,OAAO,GAAGC,MAAM,GAAGC,OAAO,GAAGC,OAAO,GAAGC,MAAM,GAAGC,OAAO,IAAIC,SAAS,IAAIC,OAAO,IAAIC,OAAO,IAAIC,QAAQ,IAAIC,OAAO,IAAIC,OAAO,IAAIC,QAAQ,GAAGC,OAAO,GAAGC,MAAM,IAAIC,MAAM,IAAIC,OAAO,IAAIC,OAAO,IAAIC,QAAQ,IAAIC,QAAQ,IAAIC,UAAU,GAAGC,OAAO,IAAIC,OAAO,IAAIC,QAAQ,IAAIC,MAAM,IAAIC,MAAM,IAAIC,OAAO,IAAIC,OAAO,IAAIC,QAAQ,IAAIC,QAAQ,GAAGC,KAAK,IAAIC,OAAO,IAAIC,MAAM,IAAIC,OAAO,GAAGC,UAAU,GAAGC,QAAQ,IAAIC,QAAQ,EAaec,SAAS,IAAIC,OAAO,IAAIC,QAAQ,IAAIC,QAAQ,IAAIC,QAAQ,IAAIC,QAAQ,IAAIC,QA AQ,IAAIC,SAAS,IAAIC,OAAO,GAAGC,UAAU,GAAGC,aAAa,GAAGC,MAAM,GAAGC,WAAW,IAAIC,aAAa,IAAIC,WAAW,GAAGC,QAAQ,GAAGC,aAAa,EAaec,WAAW,GAAGC,SAAS,GAAGC,YAAy,GAAGC,UAAU,IAAIC,aAAa,GAAGC,WAAW,EAaec,aAAa,GAAGC,YAAy,GAAGC,SAAS,GAAGC,UAAU,GAAGC,UAAU,IAAIC,aAAa,GAAGC,YAAy,GAAGC,SAAS,EAaec,aAAa,GAAGC,SAAS,GAAGC,gBAAgB,GAAGC,gBAAgB,IAAIC,cAAc,EAaec,UAAU,GAAGC,QAAQ,GAAGC,SAAS,GAAGC,aAAa,IAAIC,OAAO,IAAIC,OAAO,GAAGC,OAAO,GAAGC,QAAQ,IAAIC,UAAU,IAAIC,OAAO,GAAGC,UAAU,GAAGC,UAAU,GAAGC,gBAAgB,GAAGC,WAAW,GAAGC,SAAS,KAAK,SAASC,GAAuBC,EAAKC,GAAO,GAAGD,GAAM,GAAGA,EA AK3V,IAAmBtsB,SAAa,EAALiC,GAAWC,EAAM,EAAE,OAAO,GAAG,GAAU,GAAPA,EAAS,OAAO,EAAKA,GAAO,aAAWA,EAAMC,EAAAA,GAAS,IAAIC,EAAsBC,QAAQC,KAAK3V,IAAoB4V,IAAgC,GAAOC,EA AgB,EA AE,GAAGJ,GAAuBH,GAAqBI,QAAQI,gBAAgB9V,IAAoB4V,IAAgC,EA AEH,EAAsB,IAAkBA,IAA+BI,EAAGB,IAAtBN,GAakC,GAAE,OAAO,EAAG,IAAI5S,EAAl+S,QAAQK,OAAO/V,IAAoBsV,GAAM,EAEC,GAAO,GAAG5S,GAak,EA AE,OAAOA,EAAlkT,EAAGB,KAAK,+CAA+CIT,EA4D,SAASqT,GAAWC,GA Aa,GAAGtU,EAuB,KAAK,qFAAQf,IAAI5U,EAAY,KAAK,kDAakDjW,IAAoBiW,EAAY,IAAI,GAAG,EA AE,IAAIC,EA AQ5J,GAAQ6J,SAASF,GAAaC,EA AQE,OAAOC,YAAy/J,GAAQgK,eAAeJ,GAAS5J,GAAQiK,eAA ersB,OAAOoiB,GAAQiK,eAAerS,QAAQgS,EA AQE,QAAQ,GAAGF,EA AQE,OAAOF,aAAQzW,EAAU,SAAS+W,GAAaP,GAAa,GAAGtU,EAuB,KAAK,uFAAuF,IAAI5U,EAAY,KAAK,oDAAGe3J,GAAQ6J,SAASF,GAAq BG,OAAOIX,YAAy,CAACuX,IAAM,WAAW,SAASC,GAACt,GAAa,GAAGtU,EAuB,KAAK,wFAAwF,IAAI sU,EAAY,KAAK,qDAAqD,IAAIC,EA AQ5J,GAAQ6J,SAASF,GAAa,GAAGC,EA AQ,CAACIW,IAAoBiW,EA AY,IAAI,GAAG,EA AE,IAAIG,EA OF,EA AQE,OAAO9J,GAAQqK,mBAAmBP,IAArsC5V,EA+B,uBAAE6U,GAA6qC,IAA0xMuB,GAAtxMtK,GAAQ,CAACC,cAAc,GAAGgK,eAAe,GAAGM,oBAAoB,WAAiC,IAAtB,IA A8BrhC,EA AE,EA AE,EA Ad,IAAkCA,EAAG82B,GAAQwK,wBAAyB9M,YAAy,WAA+B,IAApB,IAAI+M,E

AAGC,GAAQ,KAAaxhC,EAAE,EAAEA,EAAE,KAAQA,EAAE0qB,IAAoB6W,EAAG,EAAEvhC,GAAG,EAAE wqB,IAAoB+W,EAAG,IAAI,GAAGA,EAAG,IAAIE,EAAQF,EAAG,IAAI/W,IAAoBiX,GAAS,GAAGA,EAAQ,I AAIc,EAAUF,GAAQ,KAAK,IAAQxhC,EAAE,EAAEA,EAAE,MAAMA,EAAE0qB,IAAoBgX,EAAU,EAAE1h C,GAAG,EAAEkGc,QAAQyB,MAAMjX,IAAoB6W,EAAG,KAAK,EAAEG,GAAWxB,QAAQyB,MAAMjX,IA AoB6W,EAAG,IAAI,EAAEA,GAAIK,GAAyBL,GAAI5V,EAA5B,GAAGkW,GAA4CN,IAAKO,WAAW,aAAan B,SAAS,GAAGoB,mBAAmB,GAAGC,gBAAGB,aAAaC,gBAAGB,WAAW,KAAMnL,GAAQiL,mBAAmBlkC,O AAO,GAAGi5B,GAAQiL,mBAAmBG,KAA3BpL,GAAsC3K,GAAwBgW,MAAGBC,MAA4BC,+BAA+B,SAAS d,EAAGe,GAAUpC,QAAQyB,MAAMjX,IAAoB6W,EAAG,IAAI,EAAE,GAAGrB,QAAQyB,MAAMjX,IAAoB6 W,EAAG,IAAI,EAAE,GAAGzK,GAAQmL,kBAAkB/B,QAAQyB,MAAMjX,IAAoB6W,EAAG,GAAG,EAAEe, GAAUpC,QAAQyB,MAAMjX,IAAoB6W,EAAG,GAAG,EAAE,GAAG1B,GAAuB0B,EAAG,EAAE,YAAyK,G AAyB,EAAE,EAAE,IAAIW,WAAW,SAASD,GAAU,IAAI,EAAGY,KAAMbZ,IAAIzK,GAAQuL,+BAA+Bd,E AAGe,GAAanW,GAAwBzC,YAAy,CAACuX,IAAM,WAAyUB,aAAa,WAAW1L,GAAQuL,+BAA+BF,MAAiB, GAAGzY,YAAy,CAACuX,IAAM,gBAAGBwB,oBAAoB,WAAW,IAAI,IAAI31B,KAAKggB,GAAQ6J,UAAcD, EAAQ5J,GAAQ6J,SAAS7zB,KAAe4zB,EAAQE,QAAQ9J,GAAQqK,mBAAmBT,EAAQE,QAAS9J,GAAQ6J,S AAS,GAAG,IAAI,IAAI3gC,EAAE,EAAEA,EAAE82B,GAAQC,cAAc15B,SAASmC,GAAO4gC,EAAO9J,GAAQ C,cAAc/2B,IAAU6gC,YAAqC,IAAZB/J,GAAQC,cAAc,GAAW/2B,EAAE,EAAEA,EAAE82B,GAAQiK,eAAelJc ,SAASmC,EAAE,CAAC,IAAI4gC,EAAqCF,GAARCE,EAAO9J,GAAQiK,eAAe/gC,IAAsB0gC,QAAQ5J,GAAQg K,eAAeJ,GAASE,EAAOC,YAAy/J,GAAQiK,eAAe,IAAID,eAAe,SAASJ,GAAS,GAAIA,EAAJ,CAAmB,GAAG A,EAAQgC,iBAAiB,CAAC,IAAIhB,EAAUIX,IAAoBkW,EAAQgC,iBAAiB,KAAK,GAAGIY,IAAoBkW,EAAQ gC,iBAAiB,KAAK,GAAG,EAAErmB,GAAMq1B,GAAWr1B,GAAMqkB,EAAQgC,kBAAkBhC,EAAQgC,iBAAi B,EAAKhC,EAAQiC,mBAAmBjC,EAAQkC,WAAUvmB,GAAMqkB,EAAQkC,WAAW1C,EAAQkC,UAAU,EA AKIC,EAAQE,SAAOF,EAAQE,OAAOF,QAAQ,QAAMS,mBAAmB,SAASP,GAAQ9J,GAAQ+L,iCAAgC,kBA AkB/L,GAAQ6J,SAASC,EAAOF,QAAQgC,kBAAkB5L,GAAQC,cAAc31B,KAAKw/B,GAAQ9J,GAAQiK,eAA ersB,OAAOoiB,GAAQiK,eAAerS,QAAQkS,GAAQ,GAAG9J,GAAQgK,eAAeF,EAAOF,SAASE,EAAOF,aAAQz W,MAAa4Y,gCAAgC,SAASzS,GAAM5F,IAAoBsY,IAA8C,GAAG,EAAE,IAAI1S,IAAO,QAAQ5F,IAAoBsY,I AA8C,GAAG,IAAIC,sBAAsB,SAAShV,KAAQkJ,uBAAuB,SAAS2J,EAAOoC,GAAMbPc,EAAOqC,UAAU,SA ASrgB,GAAG,IAAIsgB,EAAEtgB,EAAQ,KAAMqe,EAAIc,EAAO,IAAGG,GAA3FtC,EAAOF,UAAQ5J,GAAQ qM,oCAAoCvC,EAAOF,QAAQgC,kBAAoBQ,EAAgB,cAAGA,EAAgB,cAAGf,KAAgB,CAAC,IAAIiB,EAAOt M,GAAQ6J,SAASuC,EAAEG,cAAoR,OAAAnQD,EAAQA,EAAOxC,OAAOIX,YAAy9G,EAAEmL,KAAKmV,E AAgB,cAAQzV,QAAQC,MAAM,0CAA0CuT,EAAI,uBAAuBiC,EAAgB,aAAE,4CAAuCpM,GAAQqM,yCAAo ClZ,GAAiB,GAAS,gCAANgX,EAAqCqC,UAAoD,GAAS,gBAANrC,EAAqBsC,GAAY3gB,EAAEmL,WAAW,G AAS,kBAANKT,EAAuBC,GAAcgC,EAAU,aAAQ,GAAS,eAANjC,EAAoBT,GAAW0C,EAAU,aAAQ,GAAS,iB AANjC,EAA5BD,GAAakC,EAAU,aAAQ,GAAS,WAANjC,EAAgBL,EAAO4C,QAAO,EAAQR,GAakBA,EAAk BpC,GAAWA,EAAO6C,aAAY7C,EAAO6C,oBAAoB7C,EAAO6C,iBAAiB,GAAS,UAAANxC,EAAe9iC,EAAI,U AAU+kC,EAAy,SAAE,KAAKA,EAAQ,WAAQ,GAAS,aAANjC,EAAkBT,EAAl,UAAUuT,EAAy,SAAE,KAA KA,EAAQ,WAAQ,GAAS,UAAANjC,EAAeyC,MAAM,UAAUR,EAAy,SAAE,KAAKA,EAAQ,WAAQ,GAAS,SA ANjC,EAA2BL,EAAOF,SAASR,QAAQC,KAAKzV,IAAoBkW,EAAOF,QAAQgC,iBAAiB,IAAI,IAAgB5L,GA AQqK,mBAAmBP,QAAc,GAAS,gBAANK,EAAqB,IAAI0C,GAAKT,EAAc,YAAG,MAAMtgB,GAAG,GAAGA, aAAa0K,GAAW,OAAO,MAAM1K,MAAiB,eAANqe,EAAoBnK,GAAQqK,mBAAmBP,GAASB,mBAANK,EAA wBnK,GAAQiM,sBAAsBngB,EAAEmL,MAA8B,iBAAhBnL,EAAEmL,KAAK6V,OAAyBhD,EAAOIX,YAAy9 G,EAAEmL,MAAW4B,EAAI,kCAAKCsR,GAAKnK,GAAQqM,yCAAoClZ,GAAW2W,EAAOtR,QAAQ,SAAS1 M,GAAG+M,EAAI,0BAA0B/M,EAAEoK,SAAS,IAAIpK,EAAEihB,OAAO,KAAKjhB,EAAEkHb,UAAaY,IAA qBgV,EAAOmD,GAAG,WAAU,SAAShW,GAAM6S,EAAOqC,UAAU,CAACIV,KAAKA,OAAS6S,EAAOmD,G AAG,SAAQ,SAAShW,GAAM6S,EAAOtR,QAAQvB,MAAQ6S,EAAOmD,GAAG,QAAO,SAAShW,QAAS6S,E AAOIX,YAAy,CAACuX,IAAM,OAAO+C,UAAyH,Z,EAA4B,qBAAGpB,EAAWQ,WAAaA,EAAW2F,WAAaA, KAAcuR,qBAAQb,WAAW,IAAI2C,EAAcvX,EAAW,6CAA6CoK,GAAQC,cAAc31B,KAAK,IAAIwsB,OAAOq W,KAAiBC,aAAa,WAAuI,OAA3F,GAA9BpN,GAAQC,cAAc15B,SAAWi5B,GAAQwK,uBAAuBxK,GAAQG,u BAAuBH,GAAQC,cAAc,KAAOD,GAAQC,cAAc15B,OAAO,EAASi5B,GAAQC,cAAcmL,MAAkB,MAAMiC,a





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GAAU,IAAGA,IAAUvmB,GAAwB,IAATxE,EAA5B,CAA+C,IAAI+qB,GAAapqB,EAA+E,MAAvDzC,YAAY,C AACuX,IAAM,cAAcuV,WAAahrB,IAAe,IAAI8B,GAAW9B,GAAkBwE,IAAQ8G,GAAQ2L,sBAAyDzX,EAAe ,QAAEA,EAAe,OAAEQ,GAAQyE,GAAM,GAACK1E,EAAMC,EAAO,IAAI8B,GAAW9B,KAAS,GAA32CR,EA Ac,MAAE3uB,EAAM2uB,EAAGB,QAAE8L,GAAQ9L,EAAGB,QAAE8L,GAAQ9L,EAAMb,WAAEZ,EAAWY, EAAMb,WAAEsC,GAAuJ0H,GAAsB,SAASyhB,IAAGBf,IAAUW,KAAUX,KAAU1gB,GAAsByhB,IAA2IBzrB, EAYY,IAAEqrB,GAA4YrrB,EAAGB,QAAiF,IAAjD,mBAAnBA,EAAGB,UAAcA,EAAGB,QAAE,CAACA,EAAG B,UAAASA,EAAGB,QAAEntB,OAAO,GAAGmtB,EAAGB,QAAEkX,KAAIBIX,GAG5ymE,OAH00mEmB,IAAw B6D,GAAc,EAAM8G,GAAQgL,cAAauU,KAGp4mExsB,EAA8B6sB,QAkrC/f,UAAiB9M,8BCfnB,IACMD,EA DF+sB,GACE/sB,EAAiC,oBAAbE,UAA4BA,SAASC,cAAgBD,SAASC,cAAcC,SAAMC,EACHf,oBAAfC,aAA4 BN,EAAaA,GAAcM,qBAE3DysB,GAGT,IAA2E7rB,EAaOBC,EAA3FC,EAakC,oBAFpC2rB,EAAoBA,GAAqB ,IAEOA,EAakB,GAA8C3rB,EAAC,MAAE,IAAIC,SAAQ,SAASC,EAAQC,GAAQL,EAAoBI,EAAQH,EAAMBI, KAAS,IAA2BC,EAAvBC,EAAGB,GAAW,IAAID,KAAOJ,EAAWA,EAAOM,eAAeF,KAAMC,EAAGBD,GAACK J,EAAOI,IAAM,IAAyGM,GAAMb,EAUC,GAAsB,EAUC,GAaOB,EAUC,GAAqB,EAAMH,EAAMC,iBAA TI,OAAkBH,EAA6C,mBAAhBI,cAA2BH,EAAGqC,iBAAVI,SAA8C,iBAAnBA,QAAQC,UAAoD,iBAAXBD,QA AQC,SAASC,KAAgBL,GAAsBH,IAAQBE,IAAsBD,EAAsB,IAA4JS,EAAMC,EAUC,EA8BC,EAAWC,EAJ NC,EAAGB,GAAG,SAASC,EAAWC,GAAM,OAG3B,EAAMb,WAAUA,EAAMb,WAAE2B,EAAKF,GAAwB A,EAAGBE,EAA8Ef,GAA+Ca,EAAbD,EAACkB,EAAGBC,QAAQL,GAAiB,IAAyBM,UAAU,IAAIX,EAAM, SAAoBY,EAASC,GAAuH,OAA3GV,IAAOA,EAAOW,GAakBV,IAASA,EAASK,GAAgBG,EAASR,EAAoB,U AAEQ,GAAiBT,EAAGB,aAAES,EAASC,EAAO,KAAK,SAASX,EAAW,SAAoBU,GAAU,IAAIG,EAAIf,EAAM Y,GAAS,GAAiE,OAAvDG,EAAI1uB,SAAQ0uB,EAAI,IAAI5uB,WAAW4uB,IAAK/mB,EAAO+mB,EAAI1uB, QAAe0uB,GAAQnB,QAAc,KAAEnuB,OAAO,GAAemuB,QAAc,KAAE,GAAGoB,QAAQ,MAAM,KAAgBpB,Q AAAC,KAAE9nB,MAAM,GAAG8nB,QAAy,GAAE,qBAAoB,SAASqB,GAAI,KAAKA,aAAcC,IAAa,MAAMD,K AAMrB,QAAy,GAAE,qBAAqBuB,IAAuDvC,EAAGB,QAAE,WAAW,MAAM,+BAAsCa,GAAsC,oBAANgC,O AAMbZB,EAAM,SAAoB0B,GAAG,OAAOD,KAAKC,KAAIxB,EAAW,SAAoBwB,GAAG,IAAIC,EAAM,MAA uB,mBAAbC,WAAgC,IAAIzvB,WAAWyvB,WAAWF,KAA0B1nB,EAAGB,iBAA3C2nB,EAAKF,KAAKC,EA E,YAAgDC,IAA4B,oBAAZE,YAAoCA,WAA2J,oBAARE,QAAyC,oBAAVV,UAAsBA,QAAQ,IAAGA,QAAQ W,IAAID,MAAMV,QAAQY,KAAKZ,QAAQC,MAAwB,oBAAXY,SAAuBA,SAASH,SAAezC,GAAoBC,KAA0 BA,EAAuBc,EAAGB8B,KAAKC,SAASC,KAA+B,oBAAX3E,UAAwBA,SAASC,gBAAe0C,EAAGB3C,SAASC, cAAcC,KAAOJ,IAAY6C,EAAGB7C,GAAoD6C,EAH,IAAnCA,EAAGBiC,QAAQ,SAA8BjC,EAAGBkC,OAAO, EAAEIC,EAAGBmC,YAAY,KAAK,GAAwB,GAAIxC,EAAM,SAASyC,GAACK,IAAIC,EAAL,IAAIC,eAAwD,OA AzCD,EAAIE,KAAK,MAAMH,GAAL,GAAGOC,EAAG,KAACK,MAAAH,EAAL,cAAiBvD,IAAuBW,EAAW,SA ASuC,GAACK,IAAIC,EAAL,IAAIC,eAAuF,OAAxED,EAAIE,KAAK,MAAMH,GAAL,GAAGOC,EAAL,cAAa,cA AcL,EAAG,KAACK,MAAA,IAAI1wB,WAAWuwB,EAALM,YAAW/C,EAAL,SAASwC,EAALQ,EAAGOC,GAAS,IA AIR,EAAL,IAAIC,eAAeD,EAAIE,KAAK,MAAMH,GAAL,GAAMC,EAAL,cAAa,cAAcL,EAALIO,OAAO,WA A0B,KAAZP,EAALtD,QAAyB,GAAZsD,EAALtD,QAAWsD,EAALM,SAAUC,EAALOP,EAALM,UAAiBE,KAAW R,EAALQ,QAAQA,EAALQR,EAALIG,KAAK,QAAKE,IAAiYQ,EAALMrF,EAALjBsB,EAAL6sB,EAALc,OAAGyC, QAAQW,IAALsB,KAAKjC,SAAakC,EAAL3E,EAALiB,UAAgYc,QAAQY,KAAKqB,KAAKjC,SAAS,IAALrC,KA AOC,EAALoBA,EAAGBC,eAAeF,KAAMJ,EAALOI,GAACK,EAAGBD,IAAMC,EAAGB,KAAQL,EAALkB,WAAaA ,EAALkB,UAAKA,EAALoB,aAAcA,EAALoB,YAAKA,EAALa,MAAQA,EAALa,KAAoBA,EAALMB,aAAEyE,EAALWz E,EAALMB,YAAoBA,EAALsB,cAAgC,iBAALd1B,aAAwBiE,GAAM,mCAAKD,IAALIO,GAAM,EAALqB,SAAS7pB, EAALoc,EAALukN,GAAUIN,GAALW4K,GAAM,qBAAqBsC,GAAO,SAASK,EAASC,GAAO,IAAIC,EAALKpF,EA AAO,IAALmF,GAAuF,OAAhF/pB,EAALogqB,EAALK,gCAAGCD,EAAM,8BAAqCC,EAALK,SAASC,EAALMF,EA ALMG,EAALWC,EAALSh0B,EAALKi0B,GAAM,IAAIC,EAAL,CAACC,OAAS,SAASC,GAACK,IAALxD,EAAL,EAAL E,GAAGwD,MAAAA,GAALmC,IAALNA,EAALQ,CAAC,IAAIC,EAALoB,GAAfD,EAAL9yB,QAAQ,GAAyBgzB,EA ALAaF,EAALjCxD,EAAL2D,GAALWF,GAA0BA,GAACK,OAAOzD,GAAL4D,MAAQ,SAASC,GAACK,IAAL7D,EAAL2 D,GAAWE,EAALnzB,QAAoC,OAA5BozB,EAALMBD,EAAL7D,GAAYA,IAALsJiD,EAALKF,EAASC,GAALWe,EA ALAM,GAALOC,EAALM,EAALe,GAAG50B,EAALM,IAAL,IAALyD,EAALe,EAALeA,EAALeZ,EAALKSb,OAAOmC,IAAL I,CAAC,IAALioxB,EAALUX,EAALIF,EAALsvB,IAALooxB,GAAsB,IAARD,IAALUA,EAALME,MAALYH,EAALMxB,

GAAGoxB,EAAU70B,EAAKyD,KAASkxB,EAAMIxB,GAAGzD,EAAKyD,GAAK,IAAImtB,EAAIiD,EAAKkB,MAAM,KAAKJ,GAAoE,OAA7D/D,EAARy,SAA4BA,GAAK,MAAgB,WAAbM,D,EAA6BiB,EAAapE,GAAqB,YAAbmD,EAA8BkB,QAAQrE,GAAYA,EAAiQsE,CAAmBtE,GAAGb,IAARgE,GAAUO,GAAAp,GAAchE,EAAI,SAAS9wB,EAAM8zB,EAAMG,EAAWC,EAASC,GAA4B,IAAImB,GAA1BpB,EAASA,GAAU,IAA4BzwB,OAAm,SAASoP,GAAM,MAAc,WAAPA,KAAuD,MAAT,WAAbohB,GAAqCqB,IAAcnB,EAAaN,EAASC,GAAC,WAAW,OAAOE,EAAMF,EAAMG,EAAWC,EAASqB,YAAiB,IAAgzDnzB,EAAO6rB,EAAMtO,EAAsByO,EAA/0DmsB,EAAiC,oBAAAdC,YAA0B,IAAIA,YAAY,aAAQ5sB,EAAU,SAAS4H,EAAkBC,EAAK7oB,EAAI8oB,GAA6D,IAA7C,IAAIC,EAAO/oB,EAAI8oB,EAAMb+kB,EAAO7tC,EAAU6oB,EAAKglB,MAAWA,GAAQ9kB,MAAU8kB,EAAO,GAAGA,EAAO7tC,EAAI,IAAI6oB,EAAKrpB,UAAUmuC,EAAa,OAAOA,EAAYG,OAAOjlB,EAAKrpB,SAASQ,EAAI6tC,IAAyB,IAAX,IAAInmB,EAAI,GAAS1nB,EAAI6tC,GAAO,CAAC,IAAI7kB,EAAGH,EAAK7oB,KAAO,GAAQ,IAAHgpB,EAAL,CAAoD,IAAIC,EAAe,GAAZJ,EAAK7oB,KAAU,GAAa,MAAN,IAAHgpB,GAAJ,CAAmE,IAAIE,EAAe,GAAZL,EAAK7oB,KAAmG,IAAvEgpB,EAAL,MAAN,IAAHA,IAAqB,GAAHA,IAAQ,GAAGC,GAAI,EAAEC,GAAe,EAHF,IAAO,GAAGC,GAAI,GAAGC,GAAI,EAAc,GAAZL,EAAK7oB,MAAgB,MAAO0nB,GAAKyB,OAAOC,aAAaJ,OAAQ,CAAC,IAAIK,EAAGL,EAAG,MAAMtB,GAAKyB,OAAOC,aAAa,MAAMC,GAAI,GAAG,MAAS,KAAHA,SAA3Q3B,GAAKyB,OAAOC,cAAiB,GAAHJ,IAAQ,EAAEC,QAAIHvB,GAAKyB,OAAOC,aAAaJ,GAA2U,OAAOtB,EAAI,SAASY,EAAagB,EAAIR,GAAgB,OAAOQ,EAAIV,EAAkB7V,EAAOuW,EAAIR,GAAgB,GAAG,SAASS,EAAkB7B,EAAImB,EAAKW,EAAOC,GAAiB,KAAKA,EAAGB,GAAG,OAAO,EAA0D,IAAxD,IAAIC,EAASF,EAAWT,EAAOS,EAAOC,EAAGB,EAU1yB,EAAE,EAAEA,EAAE2wB,EAAI9yB,SAASmC,EAAE,CAAC,IAAI4yB,EAAEjC,EAAIkC,WAAW7yB,GAAoF,GAA9E4yB,GAAG,OAAOA,GAAG,QAAkCA,EAAE,QAAU,KAAFA,IAAS,IAAO,KAA9CjC,EAAIkC,aAAa7yB,IAAqC4yB,GAAG,IAAI,CAAC,GAAGH,GAAQT,EAAO,MAAMF,EAAKW,KAAUG,OAAO,GAAGA,GAAG,KAAK,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EAAKW,KAAU,IAAIG,GAAG,EAAEd,EAAKW,KAAU,IAAM,GAAFG,OAAU,GAAGA,GAAG,MAAM,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EAAKW,KAAU,IAAIG,GAAG,GAAGd,EAAKW,KAAU,IAAIG,GAAG,EAAE,GAAGd,EAAKW,KAAU,IAAM,GAAFG,MAAS,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EAAKW,KAAU,IAAIG,GAAG,GAAGd,EAAKW,KAAU,IAAIG,GAAG,GAAGd,EAAKW,KAAU,IAAM,GAAFG,GAAqB,OAAfd,EAAKW,GAAQ,EAASA,EAAOE,EAAS,SAAS9B,EAAaF,EAAImC,EAAOJ,GAAiB,OAAOF,EAAkB7B,EAAI3U,EAAO8W,EAAOJ,GAAiB,SAASzB,EAAmBF,EAAMtyB,GAAQ6rB,EAAm1pB,IAAImwB,EAAMtyB,GAAQ,SAASu0B,EAAQl0B,EAAEm0B,GAakD,OAArCn0B,EAAEm0B,EAAS,IAAGn0B,GAAGm0B,EAASn0B,EAAEm0B,GAAgBn0B,EAAwE,SAASurB,EAA2B6I,GAAKz0B,EAAOy0B,EAAIII,EAAc,MAAEV,EAAM,IAAI6I,UAAUD,GAAKII,EAAe,OAAS,IAAIoI,WAAWF,GAAKII,EAAe,OAAEP,EAAO,IAAIjsB,WAAW00B,GAAKII,EAAe,OAAEhP,EAAO,IAAIzd,WAAW20B,GAAKII,EAAGB,QAAU,IAAIqI,YAAYH,GAAKII,EAAGB,QAAU,IAAIsl,YAAYJ,GAAKII,EAAGB,QAAU,IAAIuI,aAAaL,GAAKII,EAAGB,QAAU,IAAIwI,aAAaN,GAAwBII,EAAuB,eAA1C,IAA0DyI,EAAcO,EAAa,GAAOC,EAAW,GAAOC,EAAW,GAAOC,EAAc,GAAyF,SAASC,IAAS,GAAGpJ,EAAe,OAA8E,IAA/C,mBAAIbA,EAAe,SAACa,EAAe,OAAE,CAACA,EAAe,SAA SA,EAAe,OAAEntB,QAAQw2B,EAAYrJ,EAAe,OAAEsJ,SAAUC,GAAqBP,GAAc,SAASQ,IAAsCD,GAAqBN,GAAY,SAASQ,IAAUF,GAAqBL,GAAY,SAASQ,IAAU,GAAG1J,EAAGB,QAAiF,IAAjD,mBAAAnBA,EAAGB,UAAcA,EAAGB,QAAE,CAACA,EAAGB,UAA SA,EAAGB,QAAEntB,QAAQ82B,EAAa3J,EAAGB,QAAEsJ,SAAUC,GAAqBJ,GAAe,SAASE,EAAYO,GAAIZ,EAAaa,QAAQD,GAAI,SAASD,EAAaC,GAAIT,EAAcU,QAAQD,GA A9tBX,EAAW7yB,KAAK,CAACgvB,KAAK,WAAW0E,QAAisB,IAAIC,EAAGB,EAAoCC,EAAsB,KAAK,SAASC,GAAiBz3B,GAAIu3B,IAAqB/J,EAA+B,wBAAGA,EAA+B,uBAAE+J,GAAkB,SAASG,GAAoB13B,GAA6G,GAAzGu3B,IAAqB/J,EAA+B,wBAAGA,EAA+B,uBAAE+J,GAAqC,GAAjBA,GAAqHC,EAAsB,CAAC,IAAI G,EAASH,EAAsBA,EAAsB,KAAKG,KAAuE,SAAS5H,GAAM6H,GAASpK,EAAGB,SAAGA,EAAGB,QAAEoK,GAAezF,EAATyF,GAAM,IAAanF,GAAM,EAakBmF,EAAG,SAASA,EAAG,+CAA+C,IAAIxS,EAAE,IAAI0G,YAAY+L,aAAaD,GAA4B,MAAtBrK,EAAMbnI,GAASA,EAAE,SAAS0S,GAAU3E,EAAI4E,GAAQ,OAAOnD,OAAOoD,UAAUC,WAAW9E,EAAI8E,WAAWF,GAA8B,IAAtB5E,EAAIjC,QAAQ6G,GAAZvK,EAAwB,gBA AE,GAAGA,EAAwB,gBAAE,GAA2W,IAAI0K,GAAc,wCAAwC,SAASC,GAAU3I,GAAU,OAAOsI,GAAUtI,E AAS0I,IAAe,IAAIE,GAAc,UAAU,SAASC,GAAU7I,GAAU,OAAOsI,GAAUtI,EAAS4I,IAAe,IAAIE,GAAe,yBA



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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
 './types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype ===
'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis
to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
```

```
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as\n KernelFunc\n};\n"}}
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Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js.map
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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
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=====

```
\n */>\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {sliceImplCPU} from
 './kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);\n\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const
xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous)
{\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n)\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1],
outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4)
{\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number,
number, number, number],\n size_ as [number, number, number, number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return
out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals:
```



```

backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n
const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i = beginI; i < endI;
i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]),
outOffset);\n outOffset += size[1];\n }\n}\n\nfunction slice3d(\n xVals: backend_util.TypedArray, xStride1:
number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size:
[number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n
const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i <
endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n
outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n
xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3:
number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number,
number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n
const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK +
size[2];\n const beginL = begin[3];\n\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++)
{\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 +
beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n
}\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n
kernelFunc: slice as { } as KernelFunc,\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)\n=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n function scatterNd(\n args: {\n backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { indices, updates } = inputs;\n const { shape } = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as KernelFunc\n }; }\n\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.js.map

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

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```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.js.map

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

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```



```

./kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
./kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
./kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
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./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
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{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
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from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n \n absConfig,\n \n addConfig,\n \n addNConfig,\n \n allConfig,\n \n anyConfig,\n \n
argMaxConfig,\n \n avgPoolConfig,\n \n batchMatMulConfig,\n \n batchToSpaceNDConfig,\n \n castConfig,\n \n
ceilConfig,\n \n clipByValueConfig,\n \n concatConfig,\n \n conv2DConfig,\n \n conv2DBackpropInputConfig,\n \n
cosConfig,\n \n coshConfig,\n \n cropAndResizeConfig,\n \n cumsumConfig,\n \n depthToSpaceConfig,\n \n
depthwiseConv2dNativeConfig,\n \n eluConfig,\n \n equalConfig,\n \n expConfig,\n \n expandDimsConfig,\n \n fillConfig,\n
 \n flipLeftRightConfig,\n \n floorConfig,\n \n floorDivConfig,\n \n fusedMatMulConfig,\n \n fusedBatchNormConfig,\n
 \n fusedConv2DConfig,\n \n fusedDepthwiseConv2DConfig,\n \n gatherNdConfig,\n \n gatherV2Config,\n \n greaterConfig,\n
 \n greaterEqualConfig,\n \n identityConfig,\n \n leakyReluConfig,\n \n lessConfig,\n \n lessEqualConfig,\n \n logConfig,\n
 \n logicalAndConfig,\n \n maxConfig,\n \n maximumConfig,\n \n maxPoolConfig,\n \n meanConfig,\n \n minConfig,\n
 \n minimumConfig,\n \n mirrorPadConfig,\n \n multiplyConfig,\n \n negConfig,\n \n nonMaxSuppressionV3Config,\n
 \n nonMaxSuppressionV4Config,\n \n nonMaxSuppressionV5Config,\n \n notEqualConfig,\n \n oneHotConfig,\n \n
onesLikeConfig,\n \n packConfig,\n \n padV2Config,\n \n powConfig,\n \n preluConfig,\n \n prodConfig,\n \n rangeConfig,\n

```

```
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}
```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/register_all_kernels.js.map
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No license file was found, but licenses were detected in source scan.

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```

```
=====\n*\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n}]]
```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Floor.js.map
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=====

```
\n *\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\nlet wasmAll: (xId: number, reduceSize: number, outId:
number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null
/*void*/, [number, number, number]);\n}\nfunction all(args: { backend: BackendWasm, inputs: AllInputs, attrs:
AllAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x }
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const
{ transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return
out;\n}\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as { } as KernelFunc;\n};
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/All.js.map

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

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CR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QA
AQ;KACT,CAAC,CAAC;AACL,CAAC;AAED,SAAS,MAAM,CACX,IAAsE;IACxE,MAAM,EAAC,MAAM,EA
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```

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```
=====\n*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n const {x, filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
```



```
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,\n $dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const\n padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =\n convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =\n convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =\n convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =\n convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type\n === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend\n Conv2D does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,\n filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport\n const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.js.map
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No license file was found, but licenses were detected in source scan.

```
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 "../src/kernels/Add.ts",
 "../src/kernels/AddN.ts",
 "../src/kernels/Identity.ts",
 "../src/kernels/Transpose.ts",
 "../src/kernels/kernel_utils.ts",
 "../src/kernels/All.ts",
 "../src/kernels/Any.ts",
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 "../src/kernels/AvgPool.ts",
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 "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js",
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 "../src/kernels/BatchToSpaceND.ts",
 "../src/kernels/Cast.ts",
 "../src/kernels/Ceil.ts",
 "../src/kernels/ClipByValue.ts",
 "../src/kernels/Concat.ts",
 "../src/kernels/Conv2D.ts",
 "../src/kernels/Conv2DBackpropInput.ts",
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 "../src/kernels/CropAndResize.ts",
 "../src/kernels/Cumsum.ts",
 "../src/kernels/DepthToSpace.ts",
 "../src/kernels/DepthwiseConv2dNative.ts",
 "../src/kernels/Elu.ts",
 "../src/kernels/Equal.ts",
 "../src/kernels/Exp.ts",
 "../src/kernels/ExpandDims.ts",
 "../src/kernels/Fill.ts",
 "../src/kernels/FlipLeftRight.ts",
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 "../src/kernels/FloorDiv.ts",
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 "../src/kernels/FusedConv2D.ts",
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 "../src/kernels/NonMaxSuppressionV5.ts",
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 "../src/kernels/SquaredDifference.ts",
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 "../src/kernels/StridedSlice.ts",
 "../src/kernels/Sub.ts",
 "../src/kernels/Sum.ts",
 "../src/kernels/Tan.ts",
 "../src/kernels/Tanh.ts",
 "../src/kernels/Tile.ts",
 "../src/kernels/TopK.ts",
 ..
```

```

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wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //
leakyreluAlpha\n 'number' // out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs:
_FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend,\n attrs} = args;\n const {a, b, bias, preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==
'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if
(bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank\n
${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n const preluActivationWeightsId =
preluActivationWeights == null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const
fusedActivation =\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if
(fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for
FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n
const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out =
backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,

```

```

transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n", "/*\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs});\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
// Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n
wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',
setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function
setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n
function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs});\n TensorInfo {\n const {backend,
inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =
backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =

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backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,
outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return
out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =
new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if
(supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const
aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>
v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n}\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}"/**\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n}"/**\n * @license\n * Copyright 2019 Google LLC. All
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n}"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as {} as
KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from
 './Identity';\nimport {CppType} from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,\n xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /*
void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n}\n\nexport function transpose(\n args:\n {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):
 TensorInfo {\n const {inputs,\n backend, attrs} = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better
due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,\n attrs.perm);\n\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n\n if (permIsNoOp) {\n const
cloned = identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,\n xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return
outShape;\n}\n\nfunction removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]]\n {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if
(shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j =
0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] >
newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape,\n newPerm];\n}\n\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName:
'wasm',\n kernelFunc: transpose as {} as KernelFunc,\n setupFunc: setup,\n};\n"/**\n * @license\n * Copyright
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=====\n\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis: number|number[],\n backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if (permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n\n return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
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=====\n\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, [number, number, number]);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n
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*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, [number, number, number]);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis,
backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*/\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from
'./kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n const {backend, inputs, attrs} = args;\n
 const {axis} = attrs as {} as ArgMaxAttrs;\n const {x} = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
 const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n }\n}\n\n const outShape = input.shape.slice(0, -1);\n const out =
backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize =
util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId,
CppType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n}\n\nexport const
argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as {}
as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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*/\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n
`was backend
only supports average pooling with dilation = [1, 1], ` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as {} as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n
return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as {} as KernelFunc\n};\n\n"/**\n *
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```
=====
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const {transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n `BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions must either be the ` +\n `same or at least one input batch dimension must be 1. Got input `
+\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and (` +\n `${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n `${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,\n innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs:
{shape: a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId
= backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim
= transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,\n rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n a3dId, aShapeBytes, a3d.shape.length, b3dId,\n bShapeBytes,\n b3d.shape.length, transposeA, transposeB, outId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n return out;\n }\n\n export const batchMatMulConfig:
KernelConfig = {\n kernelName: BatchMatMul,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
batchMatMul as {} as KernelFunc\n };
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VUZW5zb3JJbmZvKCRzaXpILCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cblxuZXhwb3J0IGNvbnN0IHNSaWN  
IQ29uZmlnOiBLZXJwZwDb25maWcgPSB7XG4gIGtlcm5lbE5hbWU6IFNsaWNILFxcuICBiYWNRZW5kTmFtZ  
TogJ2NwdScsXG4gIGtlcm5lbEZ1bmM6IHNSaWNIGFzIHt9IGFzIEtlcm5lbEZ1bmNcbn07XG4iXX0=","/\*\n \*  
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the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {sliceImplCPU} from
../kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);\n\n const xVals = backend.readSync(x.dataId);\n\n const out = backend.makeOutput(size_, x.dtype);\n\n const
xStrides = util.computeStrides(x.shape);\n\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous)
{\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n)\n\n return out;\n }\n\n if (x.dtype === 'string') {\n\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n\n outData.stringBytes = res as Uint8Array[];\n\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n\n const rank = x.shape.length;\n\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1],
outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4)
{\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number,
number, number, number],\n size_ as [number, number, number, number]);\n } else {\n\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n\n outVals.set(res);\n }\n\n return
out;\n}\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals:
backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n\n const beginI = begin[0];\n\n const beginJ = begin[1];\n\n const endI = beginI + size[0];\n\n for (let i = beginI; i < endI;
i++) {\n\n const xOffset = i * xStride + beginJ;\n\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]),
outOffset);\n\n outOffset += size[1];\n }\n}\n\nfunction slice3d(\n xVals: backend_util.TypedArray, xStride1:
number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size:
[number, number, number]): void {\n let outOffset = 0;\n\n const beginI = begin[0];\n\n const beginJ = begin[1];\n\n const beginK = begin[2];\n\n const endI = beginI + size[0];\n\n const endJ = beginJ + size[1];\n\n for (let i = beginI; i <
endI; i++) {\n\n for (let j = beginJ; j < endJ; j++) {\n\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n\n outOffset += size[2];\n }\n\n }\n}\n\nfunction slice4d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3:
number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number,
number, number, number]): void {\n let outOffset = 0;\n\n const beginI = begin[0];\n\n const beginJ = begin[1];\n\n const beginK = begin[2];\n\n const endI = beginI + size[0];\n\n const endJ = beginJ + size[1];\n\n const endK = beginK
+ size[2];\n\n const beginL = begin[3];\n\n for (let i = beginI; i < endI; i++) {\n\n for (let j = beginJ; j < endJ; j++)
{\n\n for (let k = beginK; k < endK; k++) {\n\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 +
beginL;\n\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n}
```

kernelFunc: slice as { } as KernelFunc,\n};\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from './Transpose';\n\nfunction batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs: BatchToSpaceNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape, crops } = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({ inputs: { x }, backend, attrs: { shape: reshaped } });\n const xTransposed = transpose({ inputs: { x: xReshaped }, backend, attrs: { perm: permuted } });\n const xTransposedReshaped = reshape({ inputs: { x: xTransposed }, backend, attrs: { shape: reshapedPermuted } });\n const result = slice({ inputs: { x: xTransposedReshaped }, backend, attrs: { begin: sliceBeginCoords, size: sliceSize } });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function cast(\n args: { inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm }):\n TensorInfo {\n const { inputs: { x }, attrs: { dtype }, backend } = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals = backend.toArrayFromHeap(x);\n const outVals = backend.toArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Ceil } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
```



```

'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:
BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n
const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId,
clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n
kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as
KernelFunc\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concatImplCPU } from
 '../kernel_utils/shared';\n\nimport { identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nexport function
concat(\n args: {\n inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs\n }) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId, shape: t.shape)};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =
inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,\n inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const

```



kernelFunc: conv2d as { } as KernelFunc\n};\n",/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number, filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number, topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number, yChannelStride: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n 'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n]);\n\n function conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat, dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n const { batchSize, filterHeight, filterWidth, inChannels, inHeight,\n inWidth, outChannels, outHeight, outWidth, strideHeight, strideWidth } =\n convInfo;\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides = util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride = isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =\n backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n }\n\n export const conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:\n conv2DBackpropInput as { } as KernelFunc\n};\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
```

except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing,  
software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast }\n from './Cast';\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest\n = 1\n}\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:\n number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,\n extrapolationValue: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number'\n // out id\n]);\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { method,\n extrapolationValue, cropSize } = attrs;\n const { image, boxes, boxInd } = inputs;\n const numBoxes =\n boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape =\n [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData =\n backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =\n cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n imagesData =\n backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const\n imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n extrapolationValue, outId);\n if\n (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n export const\n cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc:
```

setup,\n kernelFunc: cropAndResize as { } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' // dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs});\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim,\n permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out = permutedOut;\n if (permutation !== null) {\n const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n }\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n}\n\nreturn out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace: (\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
```

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const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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```

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*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', //
xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', //
filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
{strides, dilations, pad, dimRoundingMode} = attrs;\n\n const $dilations = dilations == null ? [1, 1] : dilations;\n\n
const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend DepthwiseConv2dNative

```

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does not support dataFormat: ` +\n \`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n })\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from
'./Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n
backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} =
attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if
(dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n

```

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 () => `Axis must be in the interval [${- (inputRank + 1)}, ${\n inputRank}]);\n $dim = inputRank + dim
+ 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape:
newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out =
backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as
number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName:
'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch:
number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n
const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n wasmFlipLeftRight(\n imageId, batch,
imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {} as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a

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batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n
'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n
'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n];\n)\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } =
attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as
Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n
FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw
new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if
(bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n `FusedConv2D only supports rank-1 bias but got ` +\n `rank
${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels
(${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:

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number, paddingBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation as {\n as key of typeof FusableActivation\n }];\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedDepthwiseConv2D only supports rank-1 bias but got` +\n `rank ${biasData.shape.length}.`);\n }\n\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape` +\n `(${biasData.shape}) does not` +\n `match the number of output channels (${outputChannels})`);\n }\n\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support` +\n `dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as {\n as KernelFunc\n };,\n};\n\n/*\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //
sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
 './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet
wasmGather: (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{\n shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize],\n backend\n });\n const
flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n
const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =

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backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n"},/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"},/**\n
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n"},/**\n
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from
'/types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n}\n\nexport function leakyRelu(\n args:\n {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm}): TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n
backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n};\n"},/**\n
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=====\n*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\nlet wasmMax: (xId:
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number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: max as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',
// inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API

```





```
!:= 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {
as KernelFunc\n};\n"},/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes,
inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {
as KernelFunc\n};\n"},/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n"},/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====
\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null / void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
=====

```

```

=====
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
=====

```

```

=====
*\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
=====

```

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=====
*\n\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in

```

```

`non_max_suppression_impl.h`.ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`. \n */\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};\n}\n\n",/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n
'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n
]);\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs:
NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n
// Since we are not using scores for V3, we have to delete it from the heap.\n
backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor
=\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //

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scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\nfunction nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n
padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as { }
as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n}\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[]
{\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma}
= attrs;\n const {boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const
scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId,
maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const {pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using
validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====

```

```

*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2020
 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
 may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmOneHot: (\n indicesId: number, depth:
 number, onValue: number, offValue: number,\n outId: number) => void;\nfunction setup(backend:
 BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n
 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n}\nfunction
 oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs,
 backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n const out =
 backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n wasmOneHot(
 indicesId, depth, onValue, offValue, outId);\n return out;\n}\nexport const oneHotConfig:
 KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
 {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
 under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *

```

```

=====\n
*\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport
 {BackendWasm} from './backend_wasm';\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
 BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
 const outVals = backend.toArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\nexport const
 onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as
 {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *

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=====\n
*\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {concat} from './Concat';\nimport
 {expandDims} from './ExpandDims';\nexport function pack(\n args: {inputs: PackInputs, backend:
 BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =
 attrs;\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim:
 axis}});\n }\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n

```



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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend } = args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' });\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as { } as KernelFunc\n }; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n xId: number, reduceSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /* void */, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n }\n export const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n }; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as {\n KernelFunc\n };,\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from
 './Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
 number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
 backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
 oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
 newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n\nfunction
 resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }):
 TensorInfo {\n const {backend, inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners,
 halfPixelCenters, size} = attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth,
 numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
 backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n
 cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
 backend.dataIdMap.get(castedData.dataId);\n }\n\n const xId = xData.id;\n\n const out =
 backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n
 const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
 oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
 (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n }\n\nexport const
 resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc:
 setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n };n", "/**\n * @license\n * Copyright 2020 Google LLC.
 All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
 file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
 http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
 './Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,
 axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
 setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n
 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n
 'number' // out_id\n]);\n\nexport function reverse(\n args: {inputs: ReverseInputs, backend: BackendWasm, attrs:
 ReverseAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} =
 attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length === 0) {\n return
 identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const axesBytes =
 new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
 Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
 outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n backend.disposeData(out.dataId);\n return
 reshaped;\n }\n\nexport const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
 setup\n };n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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=====
*\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', //
radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n}\nexport function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n const out =
backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight,
imageWidth);\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues =
typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n}\nexport const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n function scatterNd(\n args: {\n backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { indices, updates } = inputs;\n const { shape } = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

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=====\n\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: {\n inputs: SelectInputs, backend: BackendWasm\n }) {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 : \n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n }\n\n export const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n setupFunc: setup\n }; \n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
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*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
= backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId,
outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as {} as KernelFunc\n};\n", "/*\n * @license\n
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the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
 'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs});\n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n
return out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: softmax as {} as KernelFunc\n};\n", "/*\n * @license\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====

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```

=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {padV2Config} from

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./PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
paddings} = attrs;\n\n const prod = util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number,
number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const paddedX =
padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue:
0}\n }) as TensorInfo;\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape,
blockShape, prod, false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n
reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapeInputs:
ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n const
paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const transposeInputs:
TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n
const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] =
s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n
return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n
backendName: 'wasm',\n kernelFunc: splitV as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n *
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```
=====\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {\n backend: BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number,\n xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array,\n endBytes: Uint8Array,\n stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array,\n outStridesBytes: Uint8Array,\n outShapeLength: number,\n outId: number\n) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
```

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'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', //
outShapeLength\n 'number', // outId\n]);\n\nexport function stridedSlice(args: {\n backend: BackendWasm,\n
inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n
newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n
sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n
x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n
let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x},
backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is
memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have
rank at least 1, got: ${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n
// To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x},
backend, attrs: {begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:
finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out =
backend.makeOutput(finalShapeSparse, 'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes
= new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new
Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const
outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */\n\n
=====\n
*/\n\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n

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'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\nfunction sum(args: {backend:
BackendWasm, inputs: SumInputs, attrs: SumAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let
inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,\n input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,\n input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //

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x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n
]);\n}\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =\n attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out =\n backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return\n out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *

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=====
\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK:\n (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:\n boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null / void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',\n // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n}\n\nexport const topk:\n (\n args: {inputs: TopKInputs, backend: BackendWasm,\n attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes\n = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices =\n backend.makeOutput(outputShape, 'int32');\n const outIndicesId =\n backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n};\n\nexport const topkConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: topk as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmTransform: (\n imageId:\n number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:\n number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)\n => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,\n null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number',

```

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// batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //
imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n const out = backend.makeOutput(outShape,
image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imageData =
backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n const transformsData =
backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n const
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n
break;\n }\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n
outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId,
fillModeId, fillValue,\n outId);\n return out;\n }\n\nexport const transformConfig: KernelConfig = {\n
kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs});\n
TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n
for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\nexport const
unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport

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{BackendWasm} from './backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike\n} as KernelConfig;\n";\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n */
```

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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
```



```

TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptId = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptId = _scriptId || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"];var scriptDirectory=""};function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["inps

```

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ect"]=function(){return"[Emscripten Module object]";var
nodeWorkerThreads;try{nodeWorkerThreads=require("\worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("\blob:")!==""){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs");if(!nodePath)nodePath=require("\path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{}if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("\perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]arguments_=Module["arguments"];if(Module["thisProgram"]thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"]wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,\Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function

```

```

convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module[\"wasmMemory\"]};buffer=Module[\"buffer\"]}else{if(Module[\"wasmMemory\"]){wasmMemory=
Module[\"wasmMemory\"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --

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experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\\"bad
memory\\")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module[\"preRun\"]){if(typeof
Module[\"preRun\"]!==\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){a
ddOnPreRun(Module[\"preRun\"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module[\"postRun\"]){if(typeof
Module[\"postRun\"]!==\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].lengt
h){addOnPostRun(Module[\"postRun\"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\\\"addRunDependency cannot be used in a
pthread
worker\\");runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](ru
nDependencies)}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\\\"Pthread aborting at \\\"+(new
Error).stack);what+=\\\"\\\";err(what);ABORT=true;EXITSTATUS=1;what=\\\"abort(\\\"+what+\\\"). Build with -s
ASSERTIONS=1 for more info.\\\";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\\\"data:application/octet-stream;base64,\\\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\\\"file://\\\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\\\"tfjs-backend-wasm-threaded-
simd.wasm\\\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\\\"both async and sync fetching of the
wasm failed\\\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\\\"function\\\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\\\"same-
origin\\\"}).then(function(response){if(!response[\\\"ok\\\"]){throw\\\"failed to load wasm binary file at
\\\"+wasmBinaryFile+\\\"\\\"}return response[\\\"arrayBuffer\\\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\\\"a\\\":asmLibraryArg};function
receiveInstance(instance,module){var

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exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!ENVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("\wasm-
instantiate\");}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate")}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"]);}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFile)
&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("\wasm streaming compile failed: \"+reason);err("\falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("\Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,EB
ADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOCSS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return

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ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\'+ret}Module[\"_emscripten_futex_wake\"]=_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\\\":\\\"cancel\\\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb);initWorker:function(){,threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\"cmd\\\":\\\"exit\\\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\"cmd\\\":\\\"cancelDone\\\"}),terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m

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ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"]);}else
if(cmd===\'killThread\'){killThread(d["thread"]);}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"]);}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\'print\'){out("Thread \'"+d["threadId"]+\'":
\'"+d["text"])}else if(cmd===\'printErr\'){err("Thread \'"+d["threadId"]+\'": \'"+d["text"])}else
if(cmd===\'alert\'){alert("Thread \'"+d["threadId"]+\'": \'"+d["text"])}else if(cmd===\'exit\'){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}else{err(\'worker sent an unknown command
\'"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\'pthread sent
an error! \'"+e.filename+\'":\'"+e.lineno+\'":
\'"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata}));worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({cmd:"load",urlOrBlob:"Module["mainScriptUrlOrBlob"]|_scriptDir,"wasmMemory":wasmMe
memory,"wasmModule":wasmModule}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile("tfjs-
backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)},getNewWorker:function(){if(PThread.unusedWorkers.length===0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){__emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("Assertion failed: '"+UTF8ToString(condition)+'", at:
\'"+[filename?UTF8ToString(filename):\'unknown filename\'],line,func?UTF8ToString(func):\'unknown
function\')}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
__emscripten_get_now;if(ENVIRONMENT_IS_NODE){__emscripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){__emscripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!==\'undefined\'){__emscripten_get_now=dateNow}else __emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return

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value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emsripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage
e({"cmd\":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":targetThreadId,"cmd\":"processThreadQueue
e"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue"})}ret
urn 1}function _abort(){abort()}function _emsripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emsripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emsripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emsripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr)}return
0}}function
_emsripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function _emsripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retu
rn ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var

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overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence})},removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThre
ad,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return"";if(target==window)return"#window";
if(target==screen)return"#screen";return
target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}},function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var

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stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;_emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return 1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var

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GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;++){ table[i]=null }return
ret },getSource:function(shader,count,string,length){ var source="\\";for(var i=0;i<count;++){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source },createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle },registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\|webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context) }return
handle },makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){ return
GL.contexts[contextHandle] },deleteContext:function(contextHandle){ if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\object\)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null },initExtensions:f
unction(context){ if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){ if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){ GLctx.getExtension(ext) } }),populateUniformTable:function(program){ var
p=GL.programs[program];var
ptable=GL.programInfos[program]={ uniforms:{ },maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1 };var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++){ var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\)\"){ name=name.slice(0,name.lastIndexOf("\[")) }var loc=GLctx.getUniformLocation(p,name);if(loc){ var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++){ var
n=name+\["+j+\"];loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc } }
} };var __emscripten_webgl_power_preferences=[\default\,\low-power\,\high-performance\];function
__emscripten_webgl_do_create_context(target,attributes){ var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={ \alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],

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minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]];var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emsripten_webgl_create_context(a0,a1){return _emsripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emsripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iow,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer==="undefined"){err("Current
environment does not support SharedArrayBuffer, pthreads are not available!");return
6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return

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_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==(0)}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd="spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw"Canceled!"}function
_emsripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce("Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/threads.html#blocking-on-the-main-browser-thread")}function
__emsripten_do_pthread_join(thread,status,block){if(!thread){err("pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err("PThread
"+thread+" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emsripten_main_browser_thread_id()==thread){err("Main thread
"+thread+" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!=thread){err("pthread_join attempted on thread
"+thread+", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
"+thread+", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emsripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emsripten_main_thre
ad_process_queued_calls();_emsripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function __pthread_join(thread,status){return __emsripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case

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93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]|1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument

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s));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["T"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["V"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["na"]]).apply(null,arguments)};var

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nts});var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["o
a"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["pa"]]).apply(null,argument
s)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["ra"]]).apply(null,argume
nts)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["sa"]]).
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["t
a"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["ua"]]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["va"]]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["wa
"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["x
a"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ya"]]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["za"]]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["Da\
"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["Ea"]]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["Fa"]]).apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["Ga"]]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["Ha"]]).apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["Ia"]]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["Ja"]]).app
ly(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["Ka"]]).apply(null,argum
ents)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["La"]]).apply(null,a

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arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["_a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"])=

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Module["asm"][["hb"]].apply(null,arguments);var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["kb"]]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"]
["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Modu
le["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fun
ction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]
=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_
id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emsc
ripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).app
ly(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(n
ull,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){retur
n(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"]
["tb"]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(
){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=
Module["asm"][["ub"]]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscrip
ten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]
["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"]
]).apply(null,arguments)};var
_emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(_emscripten_stack_set
limits=Module["_emscripten_stack_set_limits"]=Module["asm"][["Bb"]]).apply(null,arguments)};var

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_memalign=Module[["_memalign"]=function(){return(_memalign=Module[["_memalign"]=Module[["asm\"]]["Cb
\"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module[["_emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module[["_emscripten_main_thread_futex"]=12148;Module[["cwrap"]=cwrap
;Module[["PThread"]=PThread;Module[["PThread"]=PThread;Module[["wasmMemory"]=wasmMemory;Module
[["ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name=_"ExitStatus";this.message=_"Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":_"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[["onRuntimeInitialized"]])Module[["onRuntimeInitialized"]]()};postRun(
)}if(Module[["setStatus\"]]){Module[["setStatus\"]](_"Running...");setTimeout(function(){setTimeout(function(){Mo
dule[["setStatus\"]](_"\\"),1);doRun()},1)}else{doRun()}}Module[["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":_"exitProcess","returnCode":_status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[["onExit"]])Module[["onExit"]](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[["preInit"]]){if(typeof
Module[["preInit"]]==_"function")Module[["preInit"]]=[Module[["preInit"]]];while(Module[["preInit"].length>0){
Module[["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n);}\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports[_"WasmBackendModuleThreadedSimd"] =
WasmBackendModuleThreadedSimd;\n", "export const wasmWorkerContents = 'var Module={};function
threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert(){var text=Array.prototype.slice.call(arguments).join(
\");postMessage({cmd:"alert",text:text,threadId:Module[["_pthread_self"]]()})}var
err=threadPrintErr;this.alert=threadAlert;Module[["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module[["wasmModule"],info);Module[["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===_"load"){Module[["wasmModule"]=e.data.wa
smModule;Module[["wasmMemory"]=e.data.wasmMemory;Module[["buffer"]=Module[["wasmMemory"].buffer;
Module[["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===_"string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()}))}else
if(e.data.cmd===_"objectTransfer"){Module[["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===_"run"){Module[["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module[["__emscripten_thread_init"]](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[["establishStackSpace"]](top,max);Module[["emscripten_tls_init"]](
);Module[["PThread"].receiveObjectTransfer(e.data);Module[["PThread"].setThreadStatus(Module[["_pthread_self
"]]()(),1);try{var

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result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["PThread"].threadExit(result)}catch(ex){if(ex===\Canceled!\"){Module["PThread"].threadCancel()}else
if(ex!=\unwind\"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}}else{Module["PThread"].threadExit(ex.status)}}else
se{Module["PThread"].threadExit(-2);throw ex}}}}else
if(e.data.cmd===\cancel\"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target===\setimmediate\"){}}else
if(e.data.cmd===\processThreadQueue\"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()}else{err(\worker.js received unknown command
\'+e.data.cmd);err(e.data)}}catch(ex){err(\worker.js onmessage() captured an uncaught exception:
\'+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\object\&&typeof
process.versions===\object\&&typeof process.versions.node===\string\"){self={location:{href:__filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\worker_threads\);global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\message\,function(data){onmessage({data:data})});var
nodeFS=require(\fs\);var nodeRead=function(filename){return nodeFS.readFileSync(filename,\utf8\)};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\undefined\){performance={now:function(){return Date.now()}}};";\nvar
WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=\undefined\'?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program\;var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\object\;ENVIRONMENT_IS_WORKER=typeof
importScripts===\function\;ENVIRONMENT_IS_NODE=typeof process===\object\&&typeof
process.versions===\object\&&typeof
process.versions.node===\string\;ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\/\;function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\path\).
dirname(scriptDirectory)+\^\}else{scriptDirectory=__dirname+\^\}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\fs\);if(!nodePath)nodePath=require(\path\);filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync"](filename,binary?null:\utf8\)};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,\^\)}arguments_=process["arg
v"].slice(2);process["on"](\uncaughtException\,function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"](\unhandledRejection\,abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return\["Emscripten Module object"]\}}else if(ENVIRONMENT_IS_SHELL){if(typeof

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read!=="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&(endPtr<endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var

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u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nu
ll}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var

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dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject})})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(Promise.reject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue}var func=callback.func;if(typeof
func==="number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));

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buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iiov,iiovcnt,pnum){var num=0;for(var
i=0;i<iiovcnt;i++){var ptr=HEAP32[iiov+i*8>>2];var len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]|1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var

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_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["U"]]).apply(null,arguments)};var

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_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"la"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(null,arguments)};var

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_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"]["ra"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"]["sa"]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]["ta"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]["ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]["va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]["wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]["xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["Oa"]).apply(null,arguments)};var

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_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm\"][["Pa\"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm\"][["Qa\"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm\"][["Ra\"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm\"][["Sa\"]]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm\"][["Ta\"]]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm\"][["Ua\"]]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm\"][["Va\"]]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm\"][["Wa\"]]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm\"][["Xa\"]]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm\"][["Ya\"]]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running..");setTimeout(function(){setTimeout(function(){Module["setStatus"]("\n"),1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport

```



```

type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n
return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *
util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values
as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n
memoryOffset);\n }\n }\n\n read(dataId: DataId): Promise<backend_util.BackendValues> {\n return
this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,
dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n
}\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @param force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n
}\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n
this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n
const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():
32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n
case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,

```

```

size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nfunction
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n
 WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
 });\n });\n });\n return {};\n };\n}\n\n/**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\nfunction getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n
// If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n\n return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
 if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n\n return prefix
+ path;\n };\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n\n if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n\n initAborted = true;\n const rejectMsg =\n `Make sure the server can serve the `.wasm` file relative to the ' +\n 'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers;\n
 reject({message: rejectMsg});\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has
been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath ==
null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n [var WasmBackendModuleThreadedSimd = `
+\n wasmFactoryThreadedSimd.toString()],\n {type: 'text/javascript'}\n]);\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadCount:\n module.cwrap('init_with_threads_count', null,

```



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```
=====
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\n\nregisterBackend('wasm', async () => {\n\n const {wasm} = await init();\n\n return new
BackendWasm(wasm);\n\n},
WASM_PRIORITY);\n\n], "names": ["_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup",
"Transpose", "All", "Any", "wasmFunc", "ArgMax", "AvgPool", "Reshape", "BatchMatMul", "slice_util", "buffer", "sliceI
mplCPU", "Slice", "BatchToSpaceND", "Cast", "Ceil", "ClipByValue", "concatImplCPU", "Concat", "Conv2D", "Conv2
DBackpropInput", "Cos", "Cosh", "CropAndResize", "Cumsum", "DepthToSpace", "DepthwiseConv2dNative", "Elu", "s
upportsFullBroadcast", "Equal", "Exp", "ExpandDims", "Fill", "FlipLeftRight", "Floor", "FloorDiv", "FusedBatchNorm",
"FusedConv2D", "FusedDepthwiseConv2D", "GatherNd", "GatherV2", "Greater", "GreaterEqual", "setupFunc", "Leaky
Relu", "Less", "LessEqual", "Log", "LogicalAnd", "Max", "Maximum", "MaxPool", "Mean", "Min", "Minimum", "Mirror
Pad", "Multiply", "Neg", "NonMaxSuppressionV3", "NonMaxSuppressionV4", "NonMaxSuppressionV5", "kernelFunc
", "NotEqual", "OneHot", "OnesLike", "Pack", "PadV2", "Pow", "Prelu", "Prod", "rangeImplCPU", "Range", "RealDiv", "R
elu", "Relu6", "ResizeBilinear", "Reverse", "RotateWithOffset", "Round", "Rsqrt", "ScatterNd", "Select", "Sigmoid", "Sin
", "Softmax", "SpaceToBatchND", "SplitV", "Sqrt", "Square", "SquaredDifference", "Step", "StridedSlice", "Sub", "Sum",
"Tan", "Tanh", "Tile", "TopK", "Transform", "Unpack", "ZerosLike", "registerKernel", "env", "require$$0", "require$$1",
"require$$2", "global", "require$$3", "require$$4", "tslib_1.__extends", "DataStorage", "engine", "KernelBackend", "wa
smFactoryThreadedSimd", "wasmFactory", "deprecationWarn", "registerBackend"], "mappings": ";;;;;;;;;;;;;
AAAA;;;;;;;;;;;;;AAiBA;ACA,IAAY,QAMX;AAND,WAAY,QAAQ;IACIB,6CAAW,CAAA;IACX,yCAAS,C
AAA;IACT,uCAAQ,CAAA;IACR,2CAAU,CAAA;IACV,iDAaA,CAAA;AACf,CAAC,EANW,QAAQ,KAAR,QA
AQ,QAMnB;AAED;ACA,IAAY,iBAQX;AARD,WAAY,iBAiB;IAC3B,6DAAU,CAAA;IACV,yDAAQ,CAA
A;IACR,2DAAS,CAAA;IACT,2DAAS,CAAA;IACT,mEAaA,CAAA;IACb,+DAAW,CAAA;IACX,uDAAO,CAA
A;AACT,CAAC,EARW,iBAiB,KAAjB,iBAiB;AC3B7B;;;;;;;;;;;;;AAuBA,IAAI,eAKQ,CAAC;AAEb,SAAS,
KAAK,CAAC,OAAoB;IACjC,eAAe,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACA,qBAAY,EAAE,IAAI,a
AAa;QACIE,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;QACR,OAAO;QACP,QAAQ;QACR,QAAQ;Q
ACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;QACR,QAAQ;KACT,CAAC,CAAC;A
ACL,CAAC;AAED,SAAS,gBAaB,CAAC,IAIzB;IACQ,IAAA,oBAAM,EAAE,sBAAO,EAAE,kBAAK,CAAS;I
AC/B,IAAA,YAAC,EAAE,YAAC,EAAE,kBAAI,EAAE,sDAAsB,CAAW;IAEpD,IAAI,CAAC,CAAC,KAAK,KA
AK,SAAS,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,EAAE;QACID,MAAM,IAAI,KAAK,CACX,6DAA6D,CAA
C,CAAC;KACpE;IAEM,IAAA,6BAAU,EAAE,6BAAU,EAAE,6BAAU,EAAE,qCAAc,CAAU;IACnE,IAAM,GA
AG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC/
C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,
CAAC;IAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI,IAAI,IAAI,IAAI,EAAE;QACb,IAAM,QAAQ,GA
AG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;QACpD,IAAI,QAAQ,CAAC
,KAAK,CAAC,MAAM,KAAK,CAAC,EAAE;YAC/B,MAAM,IAAI,KAAK,CACX,iDAiD;iBACjD,UAAQ,QA
AQ,CAAC,KAAK,CAAC,MAAM,MAAG,CAAA,CAAC,CAAC;SACvC;QACD,MAAM,GAAG,QAAQ,CAAC,E
AAE,CAAC;KACTB;IACD,IAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;QAC3D,CAAC;QACD,OAAO,CAAC,
SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC5D,IAAM,eAAe,GACjB,i
BAiB,CAAC,UAAkD,CAAC,CAAC;IAC1E,IAAI,eAAe,IAAI,IAAI,EAAE;QAC3B,MAAM,IAAI,KAAK,CAC
R,UAAU,mDAAGD;YAC7D,sBAAsB,CAAC,CAAC;KAC7B;IAED,IAAM,OAAO,GAAG,UAAU,GAAG,CAAC,
```

CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IACrD,IAAM,Q  
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*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

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```

=====\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //\n leakyreluAlpha\n 'number' // out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs:\n _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const { inputs, backend,\n attrs } = args;\n const { a, b, bias, preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==\n 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if\n (bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n\n throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank\n ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId =\n preluActivationWeights === null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n const\n fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n\n if\n (fusedActivation === null) {\n throw new Error(\n ` ${activation} activation not yet supported for\n FusedConv2D ` +\n ` in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n\n const batchDim = a.shape[0];\n\n const out =\n backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n

```





```

backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =
backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,
outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return
out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =
new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if
(supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const
aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>
v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet `+\n `supported for ${a.dtype} ${kernelName}.`);\n }\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n\n"/**\n * @license\n *
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```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(x: TensorInfo, axis: number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if (permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {permutedAxes}, backend});\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null, /*void*/, ['number, number, number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n \n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n \n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n \n const out = backend.makeOutput(outShape, x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n \n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n \n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n \n return out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: any as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize: number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args: { inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n \n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n \n const outShape = input.shape.slice(0, -1);\n const out =\n backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize =\n util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n \n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n \n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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```
=====\n*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const channels = convInfo.inChannels;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend
only supports average pooling with dilation = [1, 1], ` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
elements.`);\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
```

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```
=====
*import {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {reshape} from
'/Reshape';
let wasmBatchMatMul: (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) =>
void;
function setup(backend: BackendWasm) {
 wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
 null /* void */, [
 'number', // a_id
 'array', // a_shape
 'number', // a_shape.length
 'array', // b_shape
 'number', // b_shape.length
 'number', // transpose_a
 'number', // transpose_b
 'number' // out_id
]);
 function batchMatMul(args: {
 inputs: BatchMatMulInputs,
 backend: BackendWasm,
 attrs: BatchMatMulAttrs
 }) {
 const {inputs, backend, attrs} = args;
 const {a, b} = inputs;
 const {transposeA, transposeB} = attrs;
 if (a.dtype !== 'float32' || b.dtype !== 'float32') {
 throw new Error(`BatchMatMul for non float32 tensors not yet supported.`);
 }
 const aRank = a.shape.length;
 const bRank = b.shape.length;
 const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];
 const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];
 const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];
 const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];
 const outerDimsA = a.shape.slice(0, -2);
 const outerDimsB = b.shape.slice(0, -2);
 const batchDimA = util.sizeFromShape(outerDimsA);
 const batchDimB = util.sizeFromShape(outerDimsB);
 const batchDimsCompatible = batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;
 util.assert(batchDimA >= 2 && batchDimB >= 2 && batchDimsCompatible, () => `Error in matMul: the input
 batch dimensions must either be the same or at least one input batch dimension must be 1. Got input
 batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);
 const outShapeOuterDims = batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);
 const outShape = outShapeOuterDims.concat([outerShapeA, outerShapeB]);
 util.assert(innerShapeA === innerShapeB, () => `Error in matMul: inner shapes (${innerShapeA}) and
 (${innerShapeB}) of Tensors with shapes ${a.shape} and ${b.shape} and transposeA=${transposeA} and
 transposeB=${transposeB} must match.`);
 const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :
 [batchDimA, outerShapeA, innerShapeA];
 const b3dShape = transposeB ? [batchDimB, outerShapeB, innerShapeB] :
 [batchDimB, innerShapeB, outerShapeB];
 // The rest of the
 implementation is designed to operate on rank-3 tensors
 const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});
 const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});
 const a3dId = backend.dataIdMap.get(a3d.dataId).id;
 const b3dId = backend.dataIdMap.get(b3d.dataId).id;
 const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];
 const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];
 const batchDim = Math.max(batchDimA, batchDimB);
 const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);
 const outId = backend.dataIdMap.get(out.dataId).id;
 const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
 const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);
 wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes, b3d.shape.length,
 transposeA, transposeB, outId);
 backend.disposeData(a3d.dataId);
 backend.disposeData(b3d.dataId);
 out.shape = outShape;
 return out;
 }
 export const batchMatMulConfig: KernelConfig = {
 kernelName: BatchMatMul,
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: batchMatMul as KernelFunc
 };
}
/**
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```







Zyb21TdHJpbmdBcnJheVRvVWludDgob3V0QnVmLnZhbHVlcYBhcyBzdHJpbmdBXSsk7XG4gIH1cbiAgcmV0dXJuIG91dEJlZi52YWx1ZXMgYXMGVHlwZWRCbnJheTtcbn1cblxuZXhwb3J0IGZlbnN0aW9uIHNsaWNlKFxuICAgIGFyZ3M6IHtpbnB1dHM6IFNsaWNlSW5wdXRzLCBiYWNrZW5kOiBNYXR0QmFja2VuZENQVSwgYXR0cnM6IFNsaWNlQXR0cnN9KTpcbiAgICBUZw5zb3JjbmZvIHtcbiAgY29uc3Qge2lucHV0cywgYmFja2VuZCwgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNpemV9ID0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbiAgICBjb25zdCB7JGJlZ2luLCAkc2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMoeCwgYmVnaW4sIHNpemUpO1xuICBzbGljZV91dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYWNRZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUltcGwodmFscywGJlZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2VUZw5zb3JjbmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cblxuZXhwb3J0IGVbnN0IHNSaWNlQ29uZmlnOiBlZlZuZw5maWcgPSB7XG4gIGtcm5lbE5hbWU6IFNsaWNlFxuICBiYWNrZW5kTmFtZTogJ2NwdScsXG4gIGtcm5lbEZ1bmM6IHNsaWNlIGFzIHt9IGFzIEtcm5lbEZ1bmNcbn07XG4iXX0=","/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n *\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {sliceImplCPU} from
 '../kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);\n\n const xVals = backend.readSync(x.dataId);\n\n const out = backend.makeOutput(size_, x.dtype);\n\n const xStrides = util.computeStrides(x.shape);\n\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[])\n .slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.set(\n (xVals as TypedArray)\n .subarray(flatOffset, flatOffset +
util.sizeFromShape(size_));\n)\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n\n outData.stringBytes = res as Uint8Array[];\n\n return
out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n\n const rank = x.shape.length;\n\n if (rank === 2) {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as
[number, number],\n size_ as
[number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1],
outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number,
number, number, number],\n size_ as [number, number, number, number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n\n outVals.set(res);\n }\n\n return
out;\n }\n\n function slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals:
backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n\n const beginI = begin[0];\n\n const beginJ = begin[1];\n\n const endI = beginI + size[0];\n\n for (let i = beginI; i < endI;\n i++) {\n const xOffset = i * xStride + beginJ;\n\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]),
outOffset);\n\n outOffset += size[1];\n }\n }\n\n function slice3d(\n xVals: backend_util.TypedArray, xStride1:
number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size:
[number, number, number]): void {\n let outOffset = 0;\n\n const beginI = begin[0];\n\n const beginJ = begin[1];\n\n const beginK = begin[2];\n\n const endI = beginI + size[0];\n\n const endJ = beginJ + size[1];\n\n for (let i = beginI; i <
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endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n}\n\nfunction slice4d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 +\n beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,\nKernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction\nbatchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:\n BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,\ncrops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =\n backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted =\n backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:\n {x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,\n attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,\n attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return\n result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\ncast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm};\n TensorInfo {\n const {inputs:\n {x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =\n backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n}

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return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null / void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n}\nfunction clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n}\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from './kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\nexport function concat(\n args: {\n inputs: ConcatInputs,\n backend: BackendWasm,\n attrs: ConcatAttrs\n }) {\n const {inputs, backend} = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape, inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes = $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function conv2d(\n args: { inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs }) {\n const { inputs, attrs, backend } = args;\n const { x, filter } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const { strides, dilations, pad, dimRoundingMode, dataFormat } = attrs;\n const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n }\n\n export const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n }; }\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n\*\n\nimport { backend\_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend\_wasm';\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number, filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n

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outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //
outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number',
// fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n]);\n}\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n
inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2,
xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n
yChannelStride, outId);\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
conv2DBackpropInput as { } as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n", "/**\n * @license\n
* Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number, extrapolationValue: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number', // out id\n]);\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} = inputs;\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData = backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData = backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, cropWidth, InterpolationMethod[method as {}] as keyof typeof InterpolationMethod, extrapolationValue, outId);\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n export const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nimport {transpose} from './Transpose';\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CCppType) => void;\nfunction setup(backend:
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BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //\n dtype\n]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:\n CumsumAttrs});\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,\n exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype ===\n 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis\n to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut =\n backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =\n backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,\n finalDim,\n permutedOutId, CppDType[x.dtype]);\n // transpose data back if permuted\n let out =\n permutedOut;\n if (permutation !== null) {\n const undoPermutation =\n backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:\n {perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =\n {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as {} as\n KernelFunc\n };\n "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */\n =====\n *\n import {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,\n util} from '@tensorflow/tfjs-core';\n import {BackendWasm} from '../backend_wasm';\n let wasmDepthToSpace:\n (\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,\n outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n function\n setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null\n /*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n }\n export function depthToSpace(args: {\n backend: BackendWasm,\n inputs:\n DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ?\n x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?\n x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ?\n x.shape[3] : x.shape[1];\n const\n outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =\n inputDepth / (blockSize * blockSize);\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,\n outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n const\n out = backend.makeOutput(outputShape, 'float32');\n const xData = backend.dataIdMap.get(x.dataId);\n const\n xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new\n Int32Array(util.computeStrides(x.shape)).buffer);\n const outputShapeBytes =\n new Uint8Array(new\n Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new\n Int32Array(util.computeStrides(outputShape)).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,

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xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return\n out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,\n DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport\n {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,\n inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:\n number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:\n number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,\n outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null / void */, [\n 'number', //\n xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', //\n filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', //\n padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //\n dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function\n depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:\n DepthwiseConv2dNativeAttrs\n }) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const\n xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const\n {strides, dilations, pad, dimRoundingMode} = attrs;\n\n const $dilations = dilations == null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,\n strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =\n convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =\n convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =\n convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =\n convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if\n (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend DepthwiseConv2dNative\n does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =\n backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,\n padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,\n inputChannels,\n outputChannels, outId);\n\n return out;\n }\n\n export const depthwiseConv2dNativeConfig:\n KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from
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'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number'];\n);\n\n function fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n }\n\n export const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n KernelFunc\n };,\n },\n "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *"
```

```
=====\n*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\nlet wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight: number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number, dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels: number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {\n as keyof typeof FusableActivation\n }];\n if (fusedActivation == null) {\n throw
```

```

new Error(\n `${activation} activation not yet supported for FusedConv2D` +\n `in the wasm backend.`);\n
}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if
(bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n `FusedConv2D only supports rank-1 bias but got` +\n `rank
${biasData.shape.length}`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not` +\n `match the number of output channels
(${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:

```

```

FusedDepthwiseConv2DAttrs(n) {
 const {inputs, attrs, backend} = args;
 const {x, filter, bias, preluActivationWeights} = inputs;
 const {
 strides, pad, dilations, dataFormat, dimRoundingMode,
 activation, leakyreluAlpha
 } = attrs;
 const convInfo = backend_util.computeConv2DInfo(
 (x as Tensor4D).shape, (filter as Tensor4D).shape,
 strides, dilations, pad, dimRoundingMode,
 true /* depthwise */);
 const fusedActivation = FusableActivation[activation as {
 as key of typeof FusableActivation}];
 if (fusedActivation == null) {
 throw new Error(
 `${activation} activation not yet supported for FusedDepthwiseConv2D` +
 `in the wasm backend.`);
 }
 const xId = backend.dataIdMap.get(x.dataId).id;
 const filterId = backend.dataIdMap.get(filter.dataId).id;
 const outputChannels = convInfo.outChannels;
 let biasId = 0;
 if (bias != null) {
 const biasData = backend.dataIdMap.get(bias.dataId);
 if (biasData.shape.length !== 1) {
 throw new Error(
 `FusedDepthwiseConv2D only supports rank-1 bias but got` +
 `rank ${biasData.shape.length}.`);
 }
 if (biasData.shape[0] !== outputChannels) {
 throw new Error(
 `FusedDepthwiseConv2D bias shape (${biasData.shape}) does not` +
 `match the number of output channels (${outputChannels})`);
 }
 biasId = biasData.id;
 }
 const filterHeight = convInfo.filterHeight;
 const filterWidth = convInfo.filterWidth;
 const padTop = convInfo.padInfo.top;
 const padRight = convInfo.padInfo.right;
 const padBottom = convInfo.padInfo.bottom;
 const padLeft = convInfo.padInfo.left;
 const dilationHeight = convInfo.dilationHeight;
 const dilationWidth = convInfo.dilationWidth;
 const strideHeight = convInfo.strideHeight;
 const strideWidth = convInfo.strideWidth;
 const inputChannels = convInfo.inChannels;
 const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
 const batchSize = convInfo.batchSize;
 const inHeight = convInfo.inHeight;
 const inWidth = convInfo.inWidth;
 if (dataFormat !== 'NHWC') {
 throw new Error(
 `wasm backend FusedDepthwiseConv2D does not support` +
 `dataFormat: "${dataFormat}". Please use 'NHWC'`);
 }
 const out = backend.makeOutput(convInfo.outShape, 'float32');
 const outId = backend.dataIdMap.get(out.dataId).id;
 const preluActivationWeightsId = preluActivationWeights == null ? 0 :
 backend.dataIdMap.get(preluActivationWeights.dataId).id;
 wasmFusedDepthwiseConv2d(
 xId, batchSize, inHeight, inWidth, filterId, filterHeight,
 filterWidth, biasId, padTop, padRight, padBottom, padLeft,
 isSamePad, dilationHeight, dilationWidth, strideHeight,
 strideWidth, inputChannels, outputChannels, fusedActivation,
 preluActivationWeightsId, leakyreluAlpha || 0, outId);
 return out;
}
export const fusedDepthwiseConv2DConfig: KernelConfig = {
 kernelName: 'FusedDepthwiseConv2D',
 backendName: 'wasm',
 setupFunc: setup,
 kernelFunc: fusedDepthwiseConv2d as {
 as KernelFunc
 };
}
/*
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 * Licensed under the Apache License, Version 2.0 (the
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 * software distributed under the License is distributed on an
 * "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
 * either express or implied.
 * See the License for the specific language governing
 * permissions and limitations under the License.
 */
=====
import {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import {CppType} from './types';
let wasmGatherNd: (
 xId: number, dtype: CCppType, indicesId: number, numSlices: number,
 sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;
function setup(backend: BackendWasm): void {
 wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [
 'number', // xId
 'number', // dtype
 'number', // indicesId
 'number', // numSlices
 'number', // sliceRank
 'number', // sliceSize
 'array', // strides
 'number' // outId
]);
 function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): TensorInfo {
 const {backend, inputs} = args;
 const {params, indices} = inputs;
 const [resultShape, numSlices, sliceSize, strides] = gather_util.prepareAndValidate(params, indices);
 const out = backend.makeOutput(resultShape, params.dtype);
 if (numSlices === 0) {
 return out;
 }
 const indicesShape = indices.shape;
 const sliceRank = indicesShape[indicesShape.length - 1];

```

```

const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { reshape } from './Reshape';\n\nimport { CppDType } from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: { backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { x,
indices } = inputs;\n const { axis, batchDims } = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: { x },\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: { x: indices },\n attrs:
{\n shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize],\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n const stridesSize = flattenX.shape.length - 1;\n\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n", "/**\n
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *

```



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```
=====\n\n*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}\n from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from\n './types';\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,\n null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //\n out_id\n]);\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n backend: BackendWasm\n }):\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either\n float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape)\n !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CCppType[x.dtype], alpha,\n outId);\n }\n return out;\n }\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc\n };\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
```

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```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, LogicalAnd } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { reductionIndices, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
```



```

backend does not support dataFormat: ` +\n \`${convInfo.dataFormat}`'. Please use 'channelsLast'.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\nstrideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig:
KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool
as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs};\n tensorInfo { \n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n
reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'mean',
reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {}
as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport

```



```

backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as KernelFunc,\n setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n"/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

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implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)\n=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n return\n selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as\n KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean)\n=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const validOutputsTensor =\n backend.makeOutput([], 'int32', pValidOutputs);\n return [selectedIndicesTensor,\n validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
```

NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as { }  
as KernelFunc,\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under  
the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the  
License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \*  
Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed  
on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*  
=====

```
\n*\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
 './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\nlet wasmFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
 backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n}\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[\n {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma
= attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const
scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId,
maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using
validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize, 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n }]\n}\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
```

```
\n*\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
```

```
\n*\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from './backend_wasm';\nlet wasmOneHot: (\n indicesId: number, depth:
```





OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,\n CCppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n }\n\n export const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {\n KernelFunc,\n setupFunc: setup\n },\n },\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * \n */\n};\n\n=====\n\n*\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n * \n */\n};\n\n=====\n\n*\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n\n function prelu(\n args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
```

```
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =\n backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype\n !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n}\n\nexport const preluConfig:\nKernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs:\n ProdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x\n = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize\n = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as {} as\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const\n range =\n (\n args: {\n backend: BackendWasm, attrs: RangeAttrs\n }): TensorInfo => {\n const {backend, attrs} =\n args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const out = backend.makeOutput([values.length], dtype);\n const outVals =\n backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\n export const rangeConfig:
```







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```
=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { image } = inputs;\n const { radians, fillValue, center } = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues =\n typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n }\n\n export const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n };}\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
```

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```
=====\n*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CCppType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n function scatterNd(\n args: {\n backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CCppType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n\n return out;\n }\n\n export const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n };}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n\n function select(args: {inputs: SelectInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n }\n\n export const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {} as KernelFunc,\n setupFunc: setup\n };}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}):
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
= backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId,
outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc;\n};\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
 'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc;\n};\n", "/*\n * @license\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from

```



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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for  
the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
 './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/**\n *
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 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
 copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
 law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
 from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
 =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright
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 you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo}
 from '@tensorflow/tfjs-
 core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmStep:
 (xId: number, alpha: number, dtype: number, outId: number) => void;\nfunction setup(backend:
 BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction step(\n args: {backend:
 BackendWasm, inputs: StepInputs, attrs: StepAttrs}):
 TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId,
 alpha, CCppType[x.dtype], outId);\n return out;\n}\nexport const stepConfig: KernelConfig = {\n kernelName:
 Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n", "/**\n *
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 law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
 util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from
 './Reshape';\nimport {slice} from './Slice';\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,
 xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
 Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\nfunction
```

```

setup(backend: BackendWasm): void {
 \n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', //
 outShapeLength\n 'number', // outId\n]);\n\n\nexport function stridedSlice(args: {\n backend: BackendWasm,\n
 inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
 const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n
 newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n
 sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n
 x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n
 let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x},
 backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is
 memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have
 rank at least 1, got: ${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n
 // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x},
 backend, attrs: {begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:
 finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out =
 backend.makeOutput(finalShapeSparse, 'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
 xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes
 = new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new
 Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const
 outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =
 new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
 beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
 result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
 }\n\n return result;\n}\n\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
 backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n *
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 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
 *\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n
 createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
 file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
 law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 the specific language governing permissions and\n * limitations under the License.\n *
 =====\n
 *\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
 {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
 number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:

```



```

backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n
]);\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =
attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n
newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n
xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return
out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: tile as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',
// x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n
'number', // outIndicesId\n]);\n}\n\nexport const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n
const {k, sorted} = attrs;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices =
backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n\n return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,

```

```

null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number',
// batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //
imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n}\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape,
image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData =
backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const transformsData =
backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n
break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n
outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId,
fillModeId, fillValue,\n outId);\n\n return out;\n }\n\nexport const transformConfig: KernelConfig = {\n
kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\n//
We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\n\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from
 './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport
{anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig}

```

```

from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport
{ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport
{concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from
 './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
 './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
 './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n

```



```

ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n
cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n
depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n
flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n
fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n
greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n
logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n
minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n
TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\nexport const
unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====\n
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,\n 11\n])));\n\n/**\n * True if threads are supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-

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feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n";\n\nvar WasmBackendModuleThreadedSimd = (function() {\n
var __scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') __scriptDir = __scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!=="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=("./this.program");var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"]}var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw

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ex } });process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"inspect\"]=function(){return\"[Emscripten Module object]\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error(\"The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?);throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print} } else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\"undefined\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!=\"0"){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\"^\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret} }else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }if(ENVIRONMENT_IS_NODE){if(typeof
performance===\"undefined\"){global.performance=require(\"perf_hooks\").performance} } var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)} }var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){abort(\"no native wasm
support detected\")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\"Assertion failed: \"+text)}}function getCFunc(ident){var
func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \"+ident+\", make sure it is exported\");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={\"string\":function(str){var
ret=0;if(str!=\"null\"&&str!=\"undefined\"&&str!=\"0\"){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var

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ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret } };function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!==\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++
]=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module[\"wasmMemory\"];buffer=Module[\"buffer\"]}else{if(Module[\"wasmMemory\"]){wasmMemory=
Module[\"wasmMemory\"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a

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flag\");if(ENVIRONMENT_IS_NODE){console.log(\(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\("bad
memory\"))}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors
()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\("addRunDependency cannot be used in a
pthread
worker\");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\("Pthread aborting at \"+(new
Error).stack);what+="\";err(what);ABORT=true;EXITSTATUS=1;what="\abort(\"+what+\"). Build with -s
ASSERTIONS=1 for more info.\";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\("both async and sync fetching of the
wasm failed\")}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\("same-
origin\").then(function(response){if(!response["ok"]){throw\("failed to load wasm binary file at
\"+wasmBinaryFile+"\")}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function

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receiveInstance(instance,module){ var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIROMENT_IS_PTHREAD){ var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency("\wasm-
instantiate\");}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}.then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: "+reason);abort(reason)}))function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\"){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){ var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("\wasm streaming compile failed: "+reason);err("\falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm\"){try{var
exports=Module["instantiateWasm\"](info,receiveInstance);return exports} catch(e){err("\Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(PromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\Canceled!\},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return

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1 } } var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`"Atomics.notify returned an unexpected value
`"+ret}Module[["_emscripten_futex_wake"]="_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined }functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({`cmd`:"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw`"Internal Error! Null pthread_ptr in
cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)} }var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb),initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({`cmd`:"exit"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({`cmd`:"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)} }PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un

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defined)),runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e[\"data\"];var
cmd=d[\"cmd\"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d[\"targetThread\"]&&d[\"targetThread\"]!=$_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d[\"transferList\"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d[\"targetThread\"]+'\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d[\"thread\"])}else
if(cmd===\"killThread\"){killThread(d[\"thread\"])}else
if(cmd===\"cancelThread\"){cancelThread(d[\"thread\"])}else
if(cmd===\"loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\"print\"){out(\"Thread \"+d[\"threadId\"]+\":
\"+d[\"text\"])}else if(cmd===\"printErr\"){err(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else
if(cmd===\"alert\"){alert(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else
if(cmd===\"exitProcess\"){try{exit(d[\"returnCode\"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setImmediate\"){worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\": \"+e.lineno+\":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata})});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post
Message({\"cmd\":\"load\", \"urlOrBlob\":Module[\"mainScriptUrlOrBlob\"]|_scriptDir,\"wasmMemory\":wasmMe
memory,\"wasmModule\":wasmModule}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\"tfjs-
backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){__emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
__emscripten_get_now;if(ENVIRONMENT_IS_NODE){__emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){__emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined"){__emscripten_get_now=dateNow}else __emscripten_get_now=function(){return

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performance.now());function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emsripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({"cmd\":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":"targetThreadId,\\"cmd\":"processThreadQueu
e\"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emsripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emsripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emsripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\\"timed-out\\")return-
73;if(ret===\\"not-equal\\")return-6;if(ret===\\"ok\\")return 0;throw\\"Atomics.wait returned an unexpected value
\\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emsripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emsripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,addr)}return
0}}function
_emsripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require\\"os\\".cpus().length;return
navigator\\"hardwareConcurrency\\"}}function _emsripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var

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cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true }return false }var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListe
ners:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return }}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function

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_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height) } }else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1 }else{ return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){ var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emsripten_set_canvas_element_size_calling_thread(target,width,height) }else{ return
_emsripten_set_canvas_element_size_main_thread(target,width,height) } }function
_emsripten_set_current_thread_status(newStatus){ }function
_emsripten_set_thread_name(threadId,name){ }function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ ctx[\"vertexAttribDivisor\"]=function(index,divisor){ ex
t[\"vertexAttribDivisorANGLE\"](index,divisor) }; ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount) }; ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount) };
return 1 } }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension(\"OES_vertex_array_object\");if(ext){ ctx[\"createVertexArray\"]=function(){ return
ext[\"createVertexArrayOES\"]() }; ctx[\"deleteVertexArray\"]=function(vao){ ext[\"deleteVertexArrayOES\"](vao) };
ctx[\"bindVertexArray\"]=function(vao){ ext[\"bindVertexArrayOES\"](vao) }; ctx[\"isVertexArray\"]=function(vao)
{ return ext[\"isVertexArrayOES\"](vao) }; return 1 } }function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension(\"WEBGL_draw_buffers\");if(ext){ ctx[\"drawBuffers\"]=function(n,bufs){ ext[\"drawBuffers
WEBGL\"](n,bufs) }; return 1 } }function
__webgl_enable_WEBGL_multi_draw(ctx){ return!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_dra

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w\"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="\\";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)==="\"){name=name.slice(0,name.lastIndexOf("\")}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf

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ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
_HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)];var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emsripten_webgl_create_context(a0,a1){return _emsripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err}(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emsripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\":"run\","start_routine\":threadParams.startRoutine,"arg\":threadParams.arg,"threadInfoStruct\":thre
adParams.pthread_ptr,"stackBase\":threadParams.stackBase,"stackSize\":threadParams.stackSize};worker.runPthr
ead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\undefined){err("Current
environment does not support SharedArrayBuffer, pthreads are not available!");return
6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!");return 28}var transferList=[];var

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error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emsripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++)GROWABLE_HEAP_U32()[(threadInfoStruct>>2)+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\"spawnThread\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\"Canceled!\"}function
_emsripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\")}function
__emsripten_do_pthread_join(thread,status,block){if(!thread){err(\"pthread_join attempted on a null thread
pointer!\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\"PThread
\"+thread+\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emsripten_main_browser_thread_id()===thread){err(\"Main thread
\"+thread+\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\"pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\"Attempted to join thread
\"+thread+\", which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emsripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\"cmd\": \"cleanupThread\", \"thread\": thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emsripten_main_thre
ad_process_queued_calls();_emsripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function _pthread_join(thread,status){return __emsripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case

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80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var

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_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][_"R"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][_"T"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["asm"][_"U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][_"V"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][_"W"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["asm"][_"X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["asm"][_"Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["asm"][_"_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["asm"][_"ma"]).apply(null,arguments)};var

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_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][\na]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][\oa]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][\pa]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][\qa]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][\ra]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][\sa]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][\ta]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\ua]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\va]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\wa]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\xa]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\ya]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\za]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][\Aa]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][\Ba]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][\Ca]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\Da]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\Ea]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\Fa]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\Ga]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\Ha]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\Ia]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\Ja]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\Ka]).apply(null,arguments)};var

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_Reluv6=Module["_Reluv6"]=function(){return(_Reluv6=Module["_Reluv6"]=Module["asm"][["La"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Sa"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ta"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Ua"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Va"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Wa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Xa"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ya"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Za"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["_a"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["$a"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["ab"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["bb"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["cb"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["fb"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["gb"]]).apply(null,arguments)};var

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__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"])[\["hb\"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"])[\["ib\"]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"])[\["jb\"]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"])[\["kb\"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"])[\["lb\"]).apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["as
m"])[\["mb\"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"])[\["nb\"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"])[\["ob\"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]
=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["asm"])[\["pb\"]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread
_id"]=Module["asm"])[\["qb\"]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_ems
cripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"])[\["rb\"]).app
ly(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__ems
cripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"])[\["sb\"]).apply(n
ull,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){retur
n(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"]
)[\["tb\"]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(
){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=
Module["asm"])[\["ub\"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"])[\["vb\"]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscrip
ten_tls_init"]=Module["asm"])[\["wb\"]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"])[\["xb\"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"])[\["yb\"]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]
)[\["zb\"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"])[\["Ab\
"]].apply(null,arguments)};var
_emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(_emscripten_stack_set_

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nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir;if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("^")+1)}else{scriptDirectory=""}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+" , make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i

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]=args[i] } } var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==(0))stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} } var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str="";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} } }return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else {if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){ addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep

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dependencies\")(runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\\\";err(what);ABORT=true;EXITSTAT
US=1;what=\\\"abort(\\\"+what+\\\"). Build with -s ASSERTIONS=1 for more info.\\\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\\\"data:application/octet-stream;base64,\\\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\\\"file://\\\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\\\"tfjs-backend-
wasm.wasm\\\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\\\"both async and sync fetching of the
wasm failed\\\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\\\"function\\\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\\\"same-
origin\\\"}).then(function(response){if(!response[\\\"ok\\\"]){throw\\\"failed to load wasm binary file at
\\\"+wasmBinaryFile+\\\"\\\"}return response[\\\"arrayBuffer\\\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\\\"a\\\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\\\"asm\\\"]=exports;wasmMemory=Module[\\\"asm\\\"][\\\"j\\\"]};updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\\\"asm\\\"][\\\"r\\\"]};removeRunDependency(\\\"wasm-
instantiate\\\")}addRunDependency(\\\"wasm-instantiate\\\");function
receiveInstantiatedSource(output){receiveInstance(output[\\\"instance\\\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\\\"failed to asynchronously prepare
wasm: \\\"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\\\"function\\\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\\\"function\\\"){return fetch(wasmBinaryFile,{credentials:\\\"same-
origin\\\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\\\"wasm streaming compile failed: \\\"+reason);err(\\\"falling
back to ArrayBuffer instantiation\\\")};return instantiateArrayBuffer(receiveInstantiatedSource))}})else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\\\"instantiateWasm\\\"]){try{var
exports=Module[\\\"instantiateWasm\\\"](info,receiveInstance);return exports}catch(e){err(\\\"Module.instantiateWasm
callback failed with error: \\\"+e);return false}}instantiateAsync().catch(readyPromiseReject);return {}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\\\"function\\\"){callback(Module);continue}var func=callback.func;if(typeof
func===\\\"number\\\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-

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buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requeste
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iiov,iovcnt,pnum){var num=0;for(var
i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var

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_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments
);}var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,argument
s);}var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,ar
guments);}var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments);}
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,argumen
ts);}var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).app
ly(null,arguments);}var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).a
pply(null,arguments);}var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"][["z"]]).apply(null,arguments);}var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,argument
s);}var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module[
"asm"][["B"]]).apply(null,arguments);}var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).ap
ply(null,arguments);}var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments);}var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments
);}var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,argu
ments);}var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]
)=Module["asm"][["G"]]).apply(null,arguments);}var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).a
pply(null,arguments);}var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"][["I"]]).apply(null,arguments);}var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=M
odule["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments);}var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)
};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,argu
ments);}var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,argument
s);}var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Modu
le["asm"][["N"]]).apply(null,arguments);}var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,argu
ments);}var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).
apply(null,arguments);}var

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_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["_asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["_asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["_asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["_asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["_asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["_asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["_asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["_asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["_asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["_asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["_asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["_asm"][_"$_"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["_asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["_asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["_asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["_asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["_asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["_asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["_asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["_asm"][_"ha"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["_asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["_asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["_asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["_asm"][_"la"]).apply(null,arguments)};var

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_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).app
ly(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(nul
l,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,argu
ments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).app
ly(null,arguments)};var
_Reluv=Module["_Reluv"]=function(){return(_Reluv=Module["_Reluv"]=Module["asm"][["ta"]]).apply(null,argume
nts)};var
_Reluv6=Module["_Reluv6"]=function(){return(_Reluv6=Module["_Reluv6"]=Module["asm"][["ua"]]).apply(null,ar
guments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa
"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]])
.apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).ap
ply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).ap
ply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,argumen
ts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][["Ja"]]).apply(null,arguments)};var

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_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][_"Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][_"Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();
readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun()}if(Module["setStatus"]){Module["setStatus"]("Running..");setTimeout(function(){setTimeout(function(){Module["setStatus"](""),1});doRun(),1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){Module["preInit"].pop()}}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\nimport './flags_wasm';\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,\nengine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule,\nWasmFactoryConfig } from '../wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from\n '../wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from '../wasm-out/tfjs-\nbackend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from '../wasm-out/tfjs-backend-\nwasm-threaded-simd.worker.js';\nimport wasmFactory from '../wasm-out/tfjs-backend-wasm.js';\n\ninterface\nTensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:\nnumber;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport\ntype DataId = object; // object instead of { } to force non-primitive.\n\nexport class BackendWasm extends\nKernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:\nDataStorage<TensorData>;\n\n constructor(public wasm:\nBackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:\nnumber[], dtype: DataType):\n DataId {\n const dataId = { id: this.dataIdNextNumber++};\n\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return\nthis.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =\nutil.now();\n f();\n const kernelMs = util.now() - start;\n return { kernelMs};\n }\n\n move(\n dataId:\nDataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n\n this.dataIdMap.set(\n dataId,\n { id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *\nutil.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n this.dataIdMap.set(dataId, { id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id, size,\nmemoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values\nas backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\nmemoryOffset);\n }\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\nthis.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const { memoryOffset,\ndtype, shape, stringBytes } =\nthis.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\nutil.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @param force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\nthis.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData` */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\nthis.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():\n32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return { unreliable:\nfalse};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this\n * method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
```

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elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n
case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,
size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\nfunction
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n
 WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
 });\n });\n return {};\n });\n\n /**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n
// If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n }\n\n /**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\n export async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n });\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the '+\n 'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n

```



```

Used in unit tests. */
export function resetWasmPath(): void {
 wasmPath = null;
 wasmPathPrefix = null;
 wasmFileMap = {};
 customFetch = false;
 initAborted = false;
 let threadsCount = -1;
 let actualThreadsCount = -1;
 /** Sets the number of threads that will be used by XNNPACK to create
 * threadpool (default to the number of logical CPU cores).
 * This must be called before calling
 * tf.setBackend('wasm').
 */
 export function setThreadsCount(numThreads: number) {
 threadsCount = numThreads;
 }
 /** Gets the actual threads count that is used by XNNPACK.
 * It is set after the backend is initialized.
 */
 export function getThreadsCount(): number {
 if (actualThreadsCount === -1) {
 throw new Error("WASM backend not initialized.");
 }
 return actualThreadsCount;
 }
 export const
 wasmWorkerContents = `
var Module={};function threadPrintErr(){var
text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function threadAlert(){var
text=Array.prototype.slice.call(arguments).join("
");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)
}WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"],1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module[
"PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["PThread"].threadCancel()}else
if(ex!="unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}}else
if(e.data.target==="setimmediate"){}}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]()){Module["__emscripten_current_thread_
process_queued_calls"]()}else{err("worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err("worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process==="object"&&typeof
process.versions==="object"&&typeof process.versions.node==="string"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require("worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on("message",function(data){onmessage({data:data})});var
nodeFS=require("fs");var nodeRead=function(filename){return nodeFS.readFileSync(filename,"utf8")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance==="undefined"){performance={now:function(){return Date.now()}}}};"/** @license See the
LICENSE file.
*/
This code is auto-generated, do not modify this file!
const version = '3.11.0';
export

```



{version};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
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,EAAyC,iBAAXBnL,EAASiB,WAC1BmK,EAAyHr,EAAKsJ,eAAe1D,EAASID,SACzCuO,EAAyJr,EAAKsJ,eAAegH,EAAG1R,QAClCsS,EAACO,EAACO,GAASpR,EAAKsJ,eAAe0E,EAOpP,OACnDyS,EAAeL,EAAU,GACzBM,EAAaP,EAAiBC,EAAU,GAACA,EAAU,GACvDO,EAAaR,EAAiBC,EAAU,GAACK,EAC7CQ,EAAiBT,EAAiB,EAAIC,EAAU,GACChDS,EAAeR,EAAU,GACzBS,EAAaX,EAAiBE,EAAU,GAACA,EAAU,GACvDU,EAAaZ,EAAiBE,EAAU,GAACK,EAC7CW,EAAiBb,EAAiB,EAAIE,EAAU,GAehD9R,EAAMhC,EAAQiC,WAAWwG,EAASID,QAAS,WAC3CrD,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAC1CqT,EAAO1U,EAAQkB,UAAUC,IAAIgS,EAAG/R,QAAQC,GACxCiR,EAAWtS,EAAQkB,UAAUC,IAAI0P,EAAOzP,QAAQC,GACtD,OANA2R,GACI0B,EAAMpC,EAAUe,EAAW1K,EAACc,EAAa0K,EAAUC,EACHe9J,EAAy+J,EAAWC,EAAUZ,EAAavJ,EAACc,EAC5DmK,EAAQC,EAASI,EAACO,EAACO,EAACO,EAACc,EACpDC,EAAyC,EAAgBC,EAACc,EAAyC,EACtDC,EAAGBvS,GACbF,ICIGI2S,GAA0BnS,GAAwBoS,GCDIDC,GAA2BrS,GAAwBsS,GCIhE,IAAKC,GAKL,IAAIC,IALJ,SAAKD,GACHA,2BACAA,yBAFF,CAAKA,KAAAA,QAoEE,MAAME,GAAoC,CAC/CrV,WAAySv,EACZpV,YAAa,OACbC,UA7DF,SAAeC,GACbGv,GAAoBhV,EAAQC,KAAKC,MAAMgV,EAAe,KAAe,CACnE,SACA,SACA,SACA,SACA,QACA,SACA,SACA,SACA,SACA,YAmDF/U,WA/Cf,SAAuBC,GAKrB,MAAMJ,QAACA,EAAOK,OAAEA,EAAMC,MAAEA,GAASF,GAC3B+U,OAAcA,EAAMC,mBAAEA,EAakBC,SAAEA,GAAY/U,GACzCgV,MAACA,EAakC,MAAEA,EAakC,OAAEA,GAAUnV,EAEzBoV,EAAWF,EAAM9T,MAAM,IAEtBiU,EAAyC,GAAaN,EAC1B/P,EAAW,CAACmQ,EAAUC,EAAyC,EAAWL,EAAM7T,MAAM,IAE/D,IACImU,EADAC,EAAa7V,EAAQkB,UAAUC,IAAIu,EAAmIU,QAeZB,YAAhBkU,EAAM3U,QACrIV,EAAa3F,GAACK,CAACjQ,QAAAA,EAASK,OAAQ,CAACsC,EAAG2S,GAAQhV,MAAO,CAACK,MAAO,aAC/DkV,EAAa7V,EAAQkB,UAAUC,IAAIyU,EAAWxU,SAGhD,MAAM0U,EAAWD,EAAWxU,GACtB0U,EAAU/V,EAAQkB,UAAUC,IAAIoU,EAAMnU,QAAQC,GAC9C2U,EAAWWhW,EAAQkB,UAAUC,IAAIqU,EAAOpU,QAAQC,GAehDW,EAAMhC,EAAQiC,WAAWqD,EAAU,WACnCPD,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAe1C4U,EAAMb,IAAI7T,WAAW,IAAIC,WAAWiT,EAAM7T,OAAOa,QAYpE,OAVA0S,GACIc,EAAUC,EAASC,EAAUP,EAAUQ,EAakBP,EACzDC,EACAZ,GAAoBI,GACpBC,EAAoBIT,GAEN,MAAd0T,GACF5V,EAAQuH,YAAyqO,EAAWxU,QAG1BY,ICHET,IAAIkU,GAoDG,MAAMC,GAA6B,CACxCvW,WAAyww,EACZtW,YAAa,OACbC,UApDF,SAAeC,GACbkW,GAAaW,EAAQC,KAAKC,MAAMkW,EAAQ,KAAiB,CACvD,SACA,SACA,SACA,SACA,SACA,YA8CFjW,oBAzCAC,GAEA,MAAMC,OAAcA,EAAML,QAAEA,EAAMC,MAAEA,GAASF,GAC3BuC,EAACA,GAACKtC,GACN2F,KAACA,EAAIqQ,UAAEA,EAASC,QAAEA,GAAWhW,EAC7B4F,EAAQvD,EAAEIB,MAAMC,OAETBmB,EAakoH,OAAmB,YAAZtH,EAAehC,OAAmC,UAAZgC,EAAehC,OACrC,IAAM,2BAA2BgC,EAAehC,sCAErC,MAAM4V,EAACLt,EAAakD,mBAAMb,CAACP,GAAOE,GAC5D,IAAIqQ,EAAy7T,EACI,OAAhB4T,IACFC,EAAy3R,GAAU,C AACxE,OAAQ,CAACsC,EAAAA,GAAIrC,MAAO,CAACyE,KAAMwR,GAAcvW,QAAAA,KAEIE,MAAMyW,EAAepT,EAAaQD,iBAAiB,EAAGR,GAAO,GAC7D7C,EAAa8D,2BAA2B,SAAU,CAACsP,GAAevQ,GAIEE,MAAMwQ,EAAC1W,EAAQiC,WAAWuU,EAAU/U,MAAO+U,EAAU7V,OAC5DgW,EAAWH,EAAU/U,MAAMgV,GAC3BG,EAAc5W,EAAQkB,UAAUC,IAAIqV,EAAUpV,QAAQC,GACtDwV,EAAgB7W,EAAQkB,UAAUC,IAAIuV,EAAytV,QAAQC,GACHe6U,GAAWU,EAAaP,EAAy,EAAL,EAAGC,EAAU,EAAL,EAAGK,EACjDE,EAAerX,GAASmD,EAAehC,QAGrC,IAAIqB,EAAM0U,EACV,GAAoB,OAAhBH,EAASB,CAExBvU,EAAM6C,GACJ,CAACxE,OAAQ,CAACsC,EAAG+T,GAAcpW,MAAO,CAACyE,KAFb1B,EAAyT,uBAAuBP,IAECvW,QAAAA,IAC7DA,EAAQuH,YAAyIP,EAAUpV,QAC9BpB,EAAQuH,YAAymP,EAAytV,QAEIC,OAAOY,ICrDT,IAAI+U,GA6DG,MAAMC,GAAmC,CAC9CpX,WAAyqX,EACZnX,YAAa,OACbC,UA3DF,SAAeC,GACb+W,GAAmB/W,EAAQC,KAAKC,MAAM+W,EAAC,KAAe,CACjE,SACA,SACA,SACA,QACA,SACA,QACA,QACA,SACA,YakDF9W,oBA9C2BC,GAK3B,MAAMJ,QAACA,EAAOK,OAAEA,EAAMC,MAAEA,GAASF,GAC3BuC,EAACA,GAACKtC,GACN6W,UAAcA,EAASxN,WAAEA,GAAcpJ,EAE1B+S,EAAy1Q,EAAEIB,MAAM,GAKpB0V,GAJ8B,SAafzN,EAAyB/G,EAAEIB,MAAM,GAACKb,EAAEIB,MAAM,IAIhCyV,EAC7BE,GAJ6B,SAaf1N,EAAyB/G,EAAEIB,MAAM,GAACKb,EAAEIB,MAAM,IAIjCyV,EAC3BG,GAJ6B,SAaf3N,EAAyB/G,EAAEIB,MAAM,GAACKb,EAAEIB,MAAM,KAIhCyV,EAAyA,GAExCI,EAA8B,SAaf5N,EACjB,CAAC2J,EAAW8D,EAACc,EAAaC,GACvC,CAACHe,EAAWgE,EAAaF,EAACc,GAErCpV,EAAMhC,EAAQiC,WAAWqV,EAAa,WAGtC1U,EADQ5C,EAAQkB,UAAUC,IAAIwB,EAAEvB,QACpBC,GACZkW,EACF,IAAIwV,WAAW,IAAIC,WAAWQ,EAAKsJ,eAAexJ,EAAEIB,QAAQa,QAe1DkV,EAAMb,IAAIpV,WAAW,IAAIC,WAAWi



CA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA, YA+FFpa,WA3FF,SAAqBC,GAKnB,MAAM C,OAACA,EAAMC,MAAEA,EAANK,QAAEA,GAAWI,GAC3BuC,EAACA,EAACKO,OAAEA,EAAMPQ,KAA EA,EAAIC,uBAAEA,GAA0BL,GAC5CiI,QACJA,EAAOC,IACPA,EAAGgK,UACHA,EAAS7I,WACTA,EAAUI B,gBACVA,EAaeZ,H,WACfA,EAAUC,eACVA,GACEV,EAEEml,EAAWpF,EAAaqP,kBACzB/P,EAAelB,MAA QoP,EAAoBpP,MAAO6G,EAASiK,EAC5DhK,EAACK,GAEH5G,EACFnC,GAakBsB,GACtB,GAAuB,MAAnB a,EACF,MAAM,IAAIhB,MACN,GAAGG,uEAIT,MAAM6B,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAEEvB,Q AAQC,GACtCiR,EAAWtS,EAAQkB,UAAUC,IAAI0P,EAAOzP,QAAQC,GAehDuR,EAaiBnK,EAASoK,YAEh C,IAAIrR,EAAS,EACb,GAAY,MAARd,EAAC,CAChB,MAAMe,EAAWxB,EAAQkB,UAAUC,IAAIv,EAAKW ,QAC5C,GAA8B,IAA1BI,EAASC,MAAMC,OACjB,MAAM,IAAIId,MAEN,sDAAQY,EAASC,MAAMC,WAE7B, GAAIF,EAASC,MAAM,KAAOmR,EACxB,MAAM,IAAIhS,MACN,2BAA2BY,EAASC,wDACImR,MAE9CrR, EAASC,EAASH,GAGpB,MAAMsH,EAaeF,EAASE,aACxBC,EAACH,EAASG,YACvBC,EAASJ,EAASK,QAA QC,IAC1BC,EAAWP,EAASK,QAAQG,MAC5BC,EAAyT,EAASK,QAAQK,OAC7BC,EAAUX,EAASK,QAAQ O,KAC3BO,EAaiBnB,EAASmB,eAC1BD,EAAGbIB,EAASKb,cACzBL,EAaeB,EAASa,aACxBC,EAacd,EAAS c,YACvBoJ,EAAGbIK,EAASgB,WACzBqJ,EAASc,SAA1BrK,EAASK,QAAQiK,KAAkB,EAAL,EACnDM,EA AY5K,EAAS4K,UACrBC,EAAW7K,EAAS6K,SACpBC,EAAU9K,EAAS8K,QAezB,GAAMb,SAAf7J,EACF,MA AM,IAAI9I,MAEN,yDAAG8I,0BAGT,MAAM1H,EAAMhC,EAAQiC,WAAWwG,EAASnD,SAAU,WAC5CpD, EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAC1CM,EAAqD,MAA1BjB,EAC7B,EACAV,EAAQkB,U AAUC,IAAIT,EAAuBU,QAAQC,GAQzD,OANAgZ,GAClX,EAAKyQ,EAAWC,EAAUC,EAASjB,EAAU3J,EA AcC,EAC3DrH,EAASqH,EAAQG,EAAUE,EAWE,EAAS0J,EAAWIJ,EACzDD,EAaeL,EAAC,EAAoJ,EAAC C,EACzDhR,EAaiBD,EAa0BX,GAakB,EAAGkB,GAE7DF,IC1HT,IAAIwY,GA8HG,MAAMC,GAA2C,CACt D7a,WAAy8a,EACZ5a,YAAa,OACbC,UAvHF,SAaeC,GACbwa,GACIxa,EAAQC,KAAKC,MAAMwa,EAASb, KAAiB,CACxD,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SAC A,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SACA,SAC A,EAAMC,MAAEA,EAANK,QAAEA,GAAWI,GAC3BuC,EAACA,EAACKO,OAAEA,EAAMPQ,KAAEA,EA AIC,uBAAEA,GAA0BL,GAC5CiI,QACJA,EAAOC,IACPA,EAAGgK,UACHA,EAAS7I,WACTA,EAAUIB,gBA CVA,EAaeZ,H,WACfA,EAAUC,eACVA,GACEV,EAEEml,EAAWpF,EAAaqP,kBACzB/P,EAAelB,MAAQoP,E AAoBpP,MAAO6G,EAASiK,EAC5DhK,EAACK,GAaiB,GAEP5G,EACFnC,GAakBsB,GACtB,GAAuB,MAA nBa,EACF,MAAM,IAAIhB,MACN,GAAGG,gFAIT,MAAM6B,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAEEvB, QAAQC,GACtCiR,EAAWtS,EAAQkB,UAAUC,IAAI0P,EAAOzP,QAAQC,GAehDuR,EAaiBnK,EAASoK,YAE hC,IAAIrR,EAAS,EACb,GAAY,MAARd,EAAC,CAChB,MAAMe,EAAWxB,EAAQkB,UAAUC,IAAIv,EAAKW ,QAC5C,GAA8B,IAA1BI,EAASC,MAAMC,OACjB,MAAM,IAAIId,MAEN,+DAAQY,EAASC,MAAMC,WAE7 B,GAAIF,EAASC,MAAM,KAAOmR,EACxB,MAAM,IAAIhS,MACN,oCAAoCY,EAASC,wDAclmR,MAE9Cr R,EAASC,EAASH,GAGpB,MAAMsH,EAaeF,EAASE,aACxBC,EAACH,EAASG,YACvBC,EAASJ,EAASK,QA AQC,IAC1BC,EAAWP,EAASK,QAAQG,MAC5BC,EAAyT,EAASK,QAAQK,OAC7BC,EAAUX,EAASK,QAA QO,KAC3BO,EAaiBnB,EAASmB,eAC1BD,EAAGbIB,EAASKb,cACzBL,EAaeB,EAASa,aACxBC,EAacd,EAAS c,YACvBoJ,EAAGbIK,EAASgB,WACzBqJ,EAASc,SAA1BrK,EAASK,QAAQiK,KAAkB,EAAL,EACnDM,EA AY5K,EAAS4K,UACrBC,EAAW7K,EAAS6K,SACpBC,EAAU9K,EAAS8K,QAezB,GAAMb,SAAf7J,EACF,M AAM,IAAI9I,MAEN,kEAG8I,0BAGT,MAAM1H,EAAMhC,EAAQiC,WAAWwG,EAASnD,SAAU,WAC5CpD ,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAC1CM,EAAqD,MAA1BjB,EAC7B,EACAV,EAAQkB,U AAUC,IAAIT,EAAuBU,QAAQC,GAQzD,OANAmZ,GACI5X,EAAKyQ,EAAWC,EAAUC,EAASjB,EAAU3J,E AAcC,EAC3DrH,EAASqH,EAAQG,EAAUE,EAWE,EAAS0J,EAAWIJ,EACzDD,EAaeL,EAAC,EAAoJ,EA AcC,EACzDhR,EAaiBD,EAa0BX,GAakB,EAAGkB,GAE7DF,IC3HT,IAAI2Y,GAiDG,MAAMC,GAA+B,CAC 1Chb,WAAyib,EACZ/a,YAAa,OACbC,UA/CF,SAaeC,GACb2a,GAae3a,EAAQC,KAAKC,MAAM2a,EAAU,K AAe,CACzD,SACA,SACA,SACA,SACA,SACA,SACA,SACA,QACA,YAuCF1a,WAnCF,SAakBC,GAehB,MAAMJ,Q AACA,EAAOK,OAAEA,GAAUD,GACpB0a,OAACA,EAAMC,QAAEA,GAAW1a,GAEnB2a,EAaAc,EAAWpL ,EAAWvH,GACtC4S,EAAyC,mBAAMBL,EAAQC,GAERc/Y,EAAMhC,EAAQiC,WAAW+Y,EAaAf,EAaOna, OACnD,GAakB,IAAdsA,EACF,OAAOjZ,EAGT,MAAMoZ,EAaeL,EAAQtZ,MACvB4Z,EAAYD,EAaAa,EAaA 1Z,OAAS,GAG/CkB,EADQ5C,EAAQkB,UAAUC,IAAI2Z,EAAO1Z,QACzBC,GAEZia,EADctb,EAAQkB,UAA



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ACpC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====\n *\n *import {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n *import {BackendWasm} from './backend_wasm';\n *import
{permuteAxesAndTranspose} from './kernel_utils';\n *import {CppType} from './types';\n *let wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) => void;\n *function setup(backend:
BackendWasm): void {\n * wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n * 'number', // x_id\n * 'number', // dtype\n * 'number', // reduce_size\n * 'number', // out_id\n *]);\n *}\n *function max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {\n * const {backend, inputs, attrs} = args;\n * const {reductionIndices, keepDims} = attrs;\n * const {x} = inputs;\n * const xId =
backend.dataIdMap.get(x.dataId).id;\n * let inputId = xId;\n * let input = x;\n *\n * const {transposed, axes, originalAxes,
inputWasTransposed} =\n * permuteAxesAndTranspose(x, axis, backend);\n *\n * if (inputWasTransposed) {\n * const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n * input = transposed;\n * inputId =
```





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```
=====\n
*\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend
only supports average pooling with dilation = [1, 1], ` +\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as {} as KernelFunc\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js.map

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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,

```

```

batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,\n shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n const stridesSize = flattenX.shape.length - 1;\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n }\n\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/GatherV2.js.map

```

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```

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```

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* distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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* limitations under the License.
* =====
*/
/**
* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `.wasm` file which will be fetched when the wasm
* backend is initialized. See
* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
* for more details.
* @param path wasm file path or url
* @param usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*

```

```
* @doc {heading: 'Environment', namespace: 'wasm'}
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.js
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*/\\n\\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from '../backend_wasm';\\n\\nimport {CppType} from './types';\\n\\nlet wasmFunc:\\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\\n void;\\n\\nfunction setupFunc(backend:
BackendWasm): void {\\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\\n 'array', // input_ids\\n
'number', // input_ids.length\\n 'number', // dtype\\n 'number', // out_id\\n]);\\n}\\n\\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\\n const {inputs, backend} = args;\\n const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\\n\\n // Short-circuit zero-sized tensors.\\n if
(util.sizeFromShape(out.shape) === 0) {\\n return out;\\n }\\n\\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\\n
const outId = backend.dataIdMap.get(out.dataId).id;\\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\\n\\n return out;\\n}\\n\\nexport const addNConfig: KernelConfig = {\\n kernelName:
AddN,\\n backendName: 'wasm',\\n setupFunc,\\n kernelFunc: addn as { } as KernelFunc,\\n};\\n"}]
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js.map
```

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

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{ "version":3,"file":"Maximum.js","sourceRoot":"","sources":["../../src/kernels/Maximum.ts"],"names":[],"mappings":
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\\n
*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.js.map

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

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```

```

=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',
// x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n
'number', // outIndicesId\n]);\n\nexport const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n
const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices =
backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/TopK.js.map

```

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

```

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```

```

=====
*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend:

```





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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { padV2Config } from './PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nfunction spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs: SpaceToBatchNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape, paddings } = attrs;\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number, number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 + blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX = padV2Config.kernelFunc({\n inputs: { x },\n backend,\n attrs: { paddings: completePaddings, constantValue: 0 }\n }) as TensorInfo;\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n const reshapeInputs: ReshapeInputs = { x: paddedX };\n const reshapeAttrs: ReshapeAttrs = { shape: reshapedPaddedShape };\n const paddedXReshaped =\n reshape({ inputs: reshapeInputs, backend, attrs: reshapeAttrs });\n const transposeInputs: TransposeInputs = { x: paddedXReshaped };\n const transposeAttrs: TransposeAttrs = { perm: permutedReshapedPaddedPermutation };\n const paddedXT =\n transpose({ inputs: transposeInputs, backend, attrs: transposeAttrs });\n const resultReshapeInputs: ReshapeInputs = { x: paddedXT };\n const resultReshapeAttrs: ReshapeAttrs = { shape: flattenShape };\n const result = reshape(\n { inputs: resultReshapeInputs, backend, attrs: resultReshapeAttrs });\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n return result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as KernelFunc\n};\n\n}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js.map
```

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

```
{ "version": 3, "file": "NotEqual.js", "sourceRoot": "", "sources": ["../src/kernels/NotEqual.ts"], "names": [], "mappings": "AAAA;;;;;;;;;;GAeG;AACH,OAAO,EAAe,QAAQ,EAAC,MAAM,uBAAuB,CAAC;AAE7D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,cAAc,GACvB,wBAAwB,CAAC,QAAQ,EAAE,qBAAqB,EAAE,MAAM,CAAC,CAAC", "sourcesContent": ["/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n}
```





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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', //
inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction maxPool(\n args:
{ inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs }) {\n const { inputs, attrs, backend } =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it
because it uses xnpack which only\n // supports float32.\n // Add the following assert only for the WASM
backend instead of at core op\n // level.\n // TODO: add support for int32 input.\n util.assert(\n x.dtype
=== 'float32',\n () =>\n `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n\n const
{ filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm
backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig:
KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool
as { } as KernelFunc\n};\n\n}}\n
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.js.map

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{ "version": 3, "file": "Reshape.js", "sourceRoot": "", "sources": ["../src/kernels/Reshape.ts"], "names": [], "mappings": "A
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```



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nB,UAAU,EAAE,gBAAoC;IAChD,SAAS,EAAE,KAAK;CACjB,CAAC", "sourcesContent":["/\*\n \*  
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the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmRotate: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { image } = inputs;\n const { radians, fillValue, center } = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n }\n\n export const rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n };\n}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.js.map

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

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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*  
=====

```
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n\n export function mean(\n args:
 {backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}):
 TensorInfo {\n const {backend, inputs,
 attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
 backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
 inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
 !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
 transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'mean',
 reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
 util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
```



```
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed\n tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype\n !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:\n KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {\n as KernelFunc\n};\n};\n}}\n
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.js.map
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No license file was found, but licenses were detected in source scan.

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```

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```
=====\n*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu = 6\n}\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusableActivation } from\n './types';\n\nlet wasmFusedMatMul:\n (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //\n leakyreluAlpha\n 'number' // out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs:\n _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend,\n attrs} = args;\n const {a, b, bias, preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==\n 'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n const aId =\n backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank\n ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId =\n preluActivationWeights === null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n const fusedActivation =\n FusableActivation[activation as {} as keyof typeof FusableActivation];\n\n if (fusedActivation === null) {\n throw new Error(\n `${activation} activation not yet supported for\n FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out =\n backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new\n Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,\n transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return\n out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:\n 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
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=====\n\n*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId: number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\n TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',\n setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean, dtype?:\n DataType): KernelConfig {\n let wasmFunc: (aId: number, aShape: Uint8Array, aShapeLen: number, bId: number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id,\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const
```

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aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>
v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&
loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting
along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n}\n\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an `AS IS` BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as { } as KernelFunc,\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as { } as

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KernelFunc,\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { identity } from\n './Identity';\nimport { CppDType } from './types';\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,\n xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) =>\n void;\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /*\n void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n}\nexport function transpose(\n args: {\n inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs\n }):\n TensorInfo {\n const { inputs,\n backend, attrs } = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,\n attrs.perm);\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n if (permIsNoOp) {\n const cloned = identity({ inputs, backend });\n cloned.shape = outShape;\n return cloned;\n }\n const out =\n backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n wasmTranspose(\n xId,\n xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return\n out;\n}\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new\n Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n}\nfunction removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]]\n {\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if\n (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j =\n 0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] >\n newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape,\n newPerm];\n}\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName:\n 'wasm',\n kernelFunc: transpose as {\n } as KernelFunc,\n setupFunc: setup,\n};\n"/**\n * @license\n * Copyright\n 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n '../backend_wasm';\nimport { transpose } from './Transpose';\n/**\n * Compute permutation axes and do a transpose\n if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis: number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n
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originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank =\n x.shape.length;\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const\n permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let\n inputWasTransposed = false;\n if (permutedAxes !== null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes =\n backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:\n permutedAxes}, backend});\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =\n backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n }\n }\n return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n}\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:\n number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null\n /*void*/, ['number, number, number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs:\n AllAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x\n = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const\n {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if\n (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =\n transposed;\n inputId = transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId, reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return\n out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: all as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n * except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *

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*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:\n number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,\n null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,\n attrs: AnyAttrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n
```



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number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend
only supports average pooling with dilation = [1, 1],`\n `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
`License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function reshape(\n args: {inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old`\n `shape must have the same number of
elements.`);\n\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n
return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n\n"/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the `License`);\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from

```















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```
=====
*
import { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';
import { BackendWasm } from './backend_wasm';
import { sliceImplCPU } from './kernel_utils/shared';
export function slice({ inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm }) {
 const { inputs: { x }, attrs: { begin, size }, backend } = args;
 const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);
 const isContinuous = slice_util.isSliceContinuous(x.shape, begin_, size_);
 const xVals = backend.readSync(x.dataId);
 const out = backend.makeOutput(size_, x.dtype);
 const xStrides = util.computeStrides(x.shape);
 const outData = backend.dataIdMap.get(out.dataId);
 if (isContinuous) {
 const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);
 if (x.dtype === 'string') {
 outData.stringBytes = (xVals as Uint8Array[]).slice(flatOffset, flatOffset + util.sizeFromShape(size_));
 } else {
 const outVals = backend.typedArrayFromHeap(out);
 outVals.set((xVals as TypedArray).subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));
 }
 } else {
 const outVals = backend.typedArrayFromHeap(out);
 if (x.dtype === 'string') {
 const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);
 outData.stringBytes = res as Uint8Array[];
 return out;
 }
 const outVals = backend.typedArrayFromHeap(out);
 const rank = x.shape.length;
 if (rank === 2) {
 slice2d(xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number], size_ as [number, number]);
 } else if (rank === 3) {
 slice3d(xVals as TypedArray, xStrides[0], xStrides[1], outVals, begin_ as [number, number, number], size_ as [number, number, number]);
 } else if (rank === 4) {
 slice4d(xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals, begin_ as [number, number, number, number], size_ as [number, number, number, number]);
 } else {
 const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;
 outVals.set(res);
 }
 }
 return out;
}
function slice2d(xVals: backend_util.TypedArray, xStride: number, outVals: backend_util.TypedArray, begin: [number, number], size: [number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const endI = beginI + size[0];
 for (let i = beginI; i < endI; i++) {
 const xOffset = i * xStride + beginJ;
 outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);
 outOffset += size[1];
 }
}
function slice3d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, outVals: backend_util.TypedArray, begin: [number, number, number], size: [number, number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const beginK = begin[2];
 const endI = beginI + size[0];
 const endJ = beginJ + size[1];
 for (let i = beginI; i < endI; i++) {
 for (let j = beginJ; j < endJ; j++) {
 const xOffset = i * xStride1 + j * xStride2 + beginK;
 outVals.set(xVals.subarray(xOffset, xOffset + size[2]), outOffset);
 outOffset += size[2];
 }
 }
}
function slice4d(xVals: backend_util.TypedArray, xStride1: number, xStride2: number, xStride3: number, outVals: backend_util.TypedArray, begin: [number, number, number, number], size: [number, number, number, number]): void {
 let outOffset = 0;
 const beginI = begin[0];
 const beginJ = begin[1];
 const beginK = begin[2];
 const endI = beginI + size[0];
 const endJ = beginJ + size[1];
 const endK = beginK + size[2];
 const beginL = begin[3];
 for (let i = beginI; i < endI; i++) {
 for (let j = beginJ; j < endJ; j++) {
 for (let k = beginK; k < endK; k++) {
 const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;
 outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);
 outOffset += size[3];
 }
 }
 }
}
export const sliceConfig: KernelConfig = { kernelName: Slice, backendName: 'wasm', kernelFunc: slice as { } as KernelFunc };
*/**
 * @license
 * Copyright 2021 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
 * either express or implied.
 * See the License for the specific language governing
 * permissions and limitations under the License.
 *

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=====
*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ reshape } from './Reshape';\n\nimport { slice } from './Slice';\n\nimport { transpose } from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n\n const permuted =
backend_util.getPermuted(reshaped.length, blockShape.length);\n\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n\n const xTransposedReshaped = reshape(\n inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted});\n\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n
backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport
{ TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nexport function
cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n\n TensorInfo {\n const {inputs:
{x}, attrs: {dtype}, backend} = args;\n\n const out = backend.makeOutput(x.shape, dtype);\n\n const inVals =
backend.typedArrayFromHeap(x);\n\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.set(inVals);\n
return out;\n}\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n
kernelFunc: cast as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport { KernelConfig, Ceil } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:
BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId,
clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig: KernelConfig = {\n
kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as
KernelFunc\n};\n "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*/\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {concatImplCPU} from
'./kernel_utils/shared';\n\nimport {identity} from './Identity';\n\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {\n inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs\n }) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t => t.shape);\n\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
the\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
 // the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =
inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,\n inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const
outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.toArrayFromHeap(input));\n const outVals = backend.toArrayFromHeap(out);\n for (let b = 0; b <
batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const

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innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n }\n return
out;\n}\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n
'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n
'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n
'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n
'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n
'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction conv2d(\n args: { inputs: Conv2DInputs, backend:
BackendWasm, attrs: Conv2DAttrs }) {\n const { inputs, attrs, backend } = args;\n const { x, filter } = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
const { strides, dilations, pad, dimRoundingMode, dataFormat } = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
Conv2D does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n
'number', // filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n
'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n
'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n
'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n
'number', // xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n
'number', // yChannelStride\n 'number', // outId\n]);\n}\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n
inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2,
xBatchStride, xRowStride,\n xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n
yChannelStride, outId);\n return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
conv2DBackpropInput as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from

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./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
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\n*\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
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\n*\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast }\n from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest\n = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:\n number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,\n extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number'\n // out id\n]);\n}\n\nfunction cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { method,\n extrapolationValue, cropSize } = attrs;\n const { image, boxes, boxInd } = inputs;\n const numBoxes =\n boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape =\n [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData =\n backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =\n cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n imagesData =\n backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const\n out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const\n imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(\n imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n InterpolationMethod[method as {} as keyof typeof InterpolationMethod],\n extrapolationValue, outId);\n if\n (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n}\n\nexport const\n cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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*\\n\\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {CppType} from
 './types';\\n\\nimport {transpose} from './Transpose';\\n\\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\\n finalDim: number, outId: number, dtype: CppDType) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\\n 'number', // x_id\\n
'number', // exclusive\\n 'number', // reverse\\n 'number', // final_dim\\n 'number', // out_id\\n 'number' //
dtype\\n]);\\n}\\n\\nexport function cumsum(\\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs}):\\nTensorInfo {\\n const {inputs, backend, attrs} = args;\\n const {x} = inputs;\\n const {axis,
exclusive, reverse} = attrs;\\n const xRank = x.shape.length;\\n\\n util.assert(x.dtype === 'float32' || x.dtype ===
'int32',\\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\\n // permute required axis
to inner most axis\\n const permutation = backend_util.getAxesPermutation([axis], xRank);\\n let permutedX = x;\\n
if (permutation !== null) {\\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\\n }\\n
const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\\n const finalDim = permutedX.shape[permutedAxis];\\n
const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\\n permutedOutId, CppDType[x.dtype]);\\n\\n // transpose data back if permuted\\n let out =
permutedOut;\\n if (permutation !== null) {\\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\\n out = transpose(\\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\\n backend.disposeData(permutedX.dataId);\\n
backend.disposeData(permutedOut.dataId);\\n }\\n return out;\\n}\\n}\\n\\nexport const cumsumConfig: KernelConfig =
{\\n kernelName: Cumsum,\\n backendName: 'wasm',\\n setupFunc: setup,\\n kernelFunc: cumsum as {} as
KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n *
Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
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*\\n\\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nlet wasmDepthToSpace:
(\\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\\n outSize: number, outId: number) => void;\\n\\nfunction
setup(backend: BackendWasm): void {\\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\\n 'number', // xId\\n 'number', // blockSize\\n 'number', // channelsLast\\n 'array', // xStrides\\n
'number', // xStridesLength\\n 'array', // outputShape\\n 'array', // outputStrides\\n 'number', // outSize\\n
'number', // outId\\n]);\\n}\\n\\nexport function depthToSpace(args: {\\n backend: BackendWasm,\\n inputs:
DepthToSpaceInputs,\\n attrs: DepthToSpaceAttrs\\n}): TensorInfo {\\n const {backend, inputs, attrs} = args;\\n
const {x} = inputs;\\n const {blockSize, dataFormat} = attrs;\\n\\n const batchSize = x.shape[0];\\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\\n\\n const
outputHeight = inputHeight * blockSize;\\n const outputWidth = inputWidth * blockSize;\\n const outputDepth =
inputDepth / (blockSize * blockSize);\\n\\n const outputShape = (dataFormat === 'NHWC') ?\\n [batchSize,
outputHeight, outputWidth, outputDepth] :\\n [batchSize, outputDepth, outputHeight, outputWidth];\\n\\n const
out = backend.makeOutput(outputShape, 'float32');\\n\\n const xData = backend.dataIdMap.get(x.dataId);\\n const

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xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as { } as KernelFunc\n};\n"/**\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport { backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', //
xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', //
filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\nfunction
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n}) {\n const { inputs, attrs, backend } = args;\n\n const { x, filter } = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
{ strides, dilations, pad, dimRoundingMode } = attrs;\n\n const $dilations = dilations === null ? [1, 1] : dilations;\n\n
const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend DepthwiseConv2dNative
does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
 kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All

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=====\n\n*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n\"\", \"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n\"\", \"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n\"\", \"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n\n\"\", \"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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=====\n*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function fill(args: { attrs: FillAttrs, backend: BackendWasm }) {\n const { attrs: { shape, value, dtype }, backend } = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: { inputs: FlipLeftRightInputs, backend: BackendWasm }): TensorInfo {\n const { inputs, backend } = args;\n const { image } = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { FloorDiv, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =
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createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n KernelFunc\n };,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\n\nlet wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n}\n\nfunction fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
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{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n
strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } =
attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as
Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n
FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw
new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n
}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if
(bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n `FusedConv2D only supports rank-1 bias but got ` +\n `rank
${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels
(${outputChannels}).`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n ` ${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:\n
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:\n
fusedConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,\n
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {FusableActivation} from './types';\n\nlet\n
wasmfusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:\n
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:\n
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmfusedDepthwiseConv2d =\n
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //

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sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n", /*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //
outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,
indices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:

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GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n"/\*\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n }): TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n };\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
```





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padRight = convInfo.padInfo.right;\n const paddingBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm
backend does not support dataFormat:` +\n ` ${convInfo.dataFormat}'. Please use 'channelsLast.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, paddingBottom, padLeft, dilationHeight, dilationWidth,\n
strideHeight, strideWidth, inputChannels, outputChannels, outId);\n return out;\n}\n\nexport const maxPoolConfig:
KernelConfig = {\n kernelName: MaxPool,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool
as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{ backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }):\n TensorInfo {\n const { backend, inputs,
attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input =
transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n
reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean',
reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n
cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as { }
as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

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implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport\n { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:\n number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(args: { backend:\n BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let\n inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes,\n inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,\n axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape,\n input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if\n (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,\n originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as\n KernelFunc\n }; \n }\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

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=====\n\n*/\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n\n*/\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-\n core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match\n enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:\n Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction\n setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
```

```

'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n);\n}\n\nfunction
mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const
{inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /*
beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:
number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const
pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const
pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,

```

pValidOutputs};\n}\n",/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)\n=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n\n function kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n const { boxes, scores } = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n return selectedIndicesTensor;\n }\n\n export const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName: NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {\n KernelFunc,\n };}\n};\n",/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n
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parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as { }
as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n}\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[\n
{\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma
} = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const
scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId,
maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using
validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES

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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\n function oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n }\n\n export const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {\n } as KernelFunc,\n }; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

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=====\n*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.tensorArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {\n } as KernelFunc,\n}; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

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=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, \n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, \n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const packConfig: KernelConfig = {\n kernelName:
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Pack,\n backendName: 'wasm',\n kernelFunc: pack as { } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { fill } from './Fill';\nimport { CppDType } from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: { inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs }) {\n const { inputs: { x }, backend, attrs: { paddings, constantValue } } = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs: { shape: outShape, value: constantValue, dtype: x.dtype }\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n }\n\n export const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as { } as KernelFunc,\n setupFunc: setup\n }; \n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, Pow } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from '../binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\n\nlet wasmPrelu: (xId: number,
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weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n}\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if
(input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n}\n\nexport const preluConfig:
KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n}\n\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs:
ProdAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport

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{BackendWasm} from './backend_wasm';\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const
range =\n (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} =
args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const out = backend.makeOutput([values.length], dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig:
KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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=====\n
*/\n\nimport {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*/\n\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====\n
*/\n\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====\n
*/\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from
'./Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
```



```

oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n}\n\nfunction
resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n\n const {images} = inputs;\n const {alignCorners,
halfPixelCenters, size} = attrs;\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth,
numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n
cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'./Identity';\n\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,
axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n
'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n
'number' // out_id\n]);\n}\n\nexport function reverse(\n args: {inputs: ReverseInputs, backend: BackendWasm, attrs:
ReverseAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} =
attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length === 0) {\n return
identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const axesBytes =
new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
setup\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *\n
=====\n
*/\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport

```



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=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
 null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //
 sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n
 'number' // outId\n]);\n}\n\nfunction scatterNd(\n args:\n {backend: BackendWasm, inputs:
 ScatterNdInputs, attrs: ScatterNdAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices,
 updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape, updates.dtype);\n if
 (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates, sliceSize, strides,
 outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =
 backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =
 backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
 Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
 wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize,
 stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n
 kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as
 KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
 Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
 License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
 Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the
 License.\n *

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*/\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
 {BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number,
 offset: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmSelect =
 backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n
 'number', // offset\n 'number', // outId\n]);\n}\n\nfunction select(args: {inputs: SelectInputs, backend:
 BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
 backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
 backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n\n const cRank = condition.shape.length;\n const tRank =
 t.shape.length;\n\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 : \n
 util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
 const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as {}
 as KernelFunc,\n setupFunc: setup\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
 except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
 void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
 void */,\n ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n
 TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
 = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-

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circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nlet wasmFunc: (xId: number, outId:\n number, channels: number, batch: number) =>\n void;\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n}\nfunction softmax(\n args: { backend: BackendWasm,\n inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =\n args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,\n logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return\n out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2021 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { padV2Config } from\n './PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\nfunction\n spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:\n SpaceToBatchNDAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockSize,\n paddings } = attrs;\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number,\n number]> = [[0, 0]];\n completePaddings.push(...(paddings as Array<[number, number]>));\n for (let i = 1 +\n blockSize.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX =\n padV2Config.kernelFunc({\n inputs: { x },\n backend,\n attrs: { paddings: completePaddings, constantValue:
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0})\n }) as TensorInfo;\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape,
blockShape, prod, false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n
reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapeInputs:
ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n const
paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const transposeInputs:
TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n
const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] =
s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n
return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName:
'wasm',\n kernelFunc: splitV as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from

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./unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmStep: (xId: number, alpha: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\nfunction step(\n args: {\n backend: BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CCppType[x.dtype], outId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array, xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n}\n\nexport function stridedSlice(\n args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n
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 x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n let result;\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x},\n backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is\n memory contiguous (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have\n rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x},\n backend, attrs: {begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:\n finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out =\n backend.makeOutput(finalShapeSparse, 'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const\n xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes\n = new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new\n Int32Array($end).buffer);\n const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const\n outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes =\n new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,\n beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n backend.disposeData(out.dataId);\n }\n\n return result;\n }\n\n export const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n };
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 =====\n\n /**\n * @nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\n * nimport {createBinaryKernelConfig} from\n * './binary_kernel';\n * nconst supportsFullBroadcast = true;\n * nexport const subConfig: KernelConfig =\n * n\n * createBinaryKernelConfig(Sub, supportsFullBroadcast);\n * n", /**\n * @license\n * Copyright 2019 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
 =====\n\n /**\n * nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from\n * '@tensorflow/tfjs-core';\n * nimport {BackendWasm} from '../backend_wasm';\n * nimport\n * {permuteAxesAndTranspose} from './kernel_utils';\n * nimport {CppType} from './types';\n * n\n * let wasmSum: (xId:\n * number, reduceSize: number, dtype: number, outId: number) =>\n * void;\n * n\n * function setup(backend:\n * BackendWasm): void {\n * wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n * 'number', // input_id\n * 'number', // reduce_size\n * 'number', // dtype\n * 'number', // out_id\n *]);\n * n\n * function sum(args: {backend:\n * BackendWasm, inputs: SumInputs, attrs: SumAttrs}): \n * TensorInfo {\n * const {backend, inputs, attrs} = args;\n * const {axis, keepDims} = attrs;\n * const {x} = inputs;\n * const xId = backend.dataIdMap.get(x.dataId).id;\n * let\n * inputId = xId;\n * let input = x;\n * const {transposed, axes, originalAxes, inputWasTransposed} =\n * permuteAxesAndTranspose(x, axis, backend);\n * let reductionAxes = axes;\n * if (inputWasTransposed) {\n * const\n * transposedId = backend.dataIdMap.get(transposed.dataId).id;\n * if (transposedId !== xId) {\n * // transpose was\n * not a no-op. We will need to dispose of this\n * // once we are done.\n * input = transposed;\n * inputId =

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transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\nbackend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n",/*\n * @license\n * Copyright 2021 Google
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n",/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n",/*\n * @license\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //
x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n
]);\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} =
attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n
newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n

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xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return\n out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: tile as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

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=====\n\n*/\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-\n core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmTopK:\n (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:\n boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk:\n (\n args: { inputs: TopKInputs, backend: BackendWasm,\n attrs: TopKAttrs }) =>\n TensorInfo[] | TensorInfo = ({ inputs, backend, attrs }) => {\n const { x } = inputs;\n const { k, sorted } = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes\n = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices =\n backend.makeOutput(outputShape, 'int32');\n const outIndicesId =\n backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: topk as {} as KernelFunc\n }; \n}"/**\n * @license\n * Copyright 2021 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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```

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=====\n\n*/\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:\n number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:\n number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)\n => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,\n null /* void */, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', //\n imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //\n interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n function transform(\n args:\n { backend: BackendWasm, inputs: TransformInputs, attrs:\n TransformAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth,\n numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
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[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape,
image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData =
backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const transformsData =
backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n
break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n
outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId,
fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const transformConfig: KernelConfig = {\n
kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs}):\n
TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n
i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n
for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n\n return outs.map(({dataId, dtype}) => ({dataId, dtype, shape: outShape}));\n}\n\nexport const
unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as { } as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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```

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We explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.
import {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';
import {fusedMatMulConfig} from './kernels/_FusedMatMul';
import {absConfig} from './kernels/Abs';
import {addConfig} from './kernels/Add';
import {addNConfig} from './kernels/AddN';
import {allConfig} from './kernels/All';
import {anyConfig} from './kernels/Any';
import {argMaxConfig} from './kernels/ArgMax';
import {avgPoolConfig} from './kernels/AvgPool';
import {batchMatMulConfig} from './kernels/BatchMatMul';
import {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';
import {castConfig} from './kernels/Cast';
import {ceilConfig} from './kernels/Ceil';
import {clipByValueConfig} from './kernels/ClipByValue';
import {concatConfig} from './kernels/Concat';
import {conv2DConfig} from './kernels/Conv2D';
import {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';
import {cosConfig} from './kernels/Cos';
import {coshConfig} from './kernels/Cosh';
import {cropAndResizeConfig} from './kernels/CropAndResize';
import {cumsumConfig} from './kernels/Cumsum';
import {depthToSpaceConfig} from './kernels/DepthToSpace';
import {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';
import {eluConfig} from './kernels/Elu';
import {equalConfig} from './kernels/Equal';
import {expConfig} from './kernels/Exp';
import {expandDimsConfig} from './kernels/ExpandDims';
import {fillConfig} from './kernels/Fill';
import {flipLeftRightConfig} from './kernels/FlipLeftRight';
import {floorConfig} from './kernels/Floor';
import {floorDivConfig} from './kernels/FloorDiv';
import {fusedBatchNormConfig} from './kernels/FusedBatchNorm';
import {fusedConv2DConfig} from './kernels/FusedConv2D';
import {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';
import {gatherNdConfig} from './kernels/GatherNd';
import {gatherV2Config} from './kernels/GatherV2';
import {greaterConfig} from './kernels/Greater';
import {greaterEqualConfig} from './kernels/GreaterEqual';
import {identityConfig} from './kernels/Identity';
import {leakyReluConfig} from './kernels/LeakyRelu';
import {lessConfig} from './kernels/Less';
import {lessEqualConfig} from './kernels/LessEqual';
import {logConfig} from './kernels/Log';
import {logicalAndConfig} from './kernels/LogicalAnd';
import {maxConfig} from './kernels/Max';
import {maximumConfig} from './kernels/Maximum';
import {maxPoolConfig} from './kernels/MaxPool';
import {meanConfig} from './kernels/Mean';
import {minConfig} from './kernels/Min';
import {minimumConfig} from './kernels/Minimum';
import {mirrorPadConfig} from './kernels/MirrorPad';
import {multiplyConfig} from './kernels/Multiply';
import {negConfig} from './kernels/Neg';
import {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';
import {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';
import {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';
import {notEqualConfig} from './kernels/NotEqual';
import {oneHotConfig} from './kernels/OneHot';
import {onesLikeConfig} from './kernels/OnesLike';
import {packConfig} from './kernels/Pack';
import {padV2Config} from './kernels/PadV2';
import {powConfig} from './kernels/Pow';
import {preluConfig} from './kernels/Prelu';
import {prodConfig} from './kernels/Prod';
import {rangeConfig} from './kernels/Range';
import {realDivConfig} from './kernels/RealDiv';
import {reluConfig} from './kernels/Relu';
import {relu6Config} from './kernels/Relu6';
import {reshapeConfig} from './kernels/Reshape';
import {resizeBilinearConfig} from './kernels/ResizeBilinear';
import {reverseConfig} from './kernels/Reverse';
import {rotateWithOffsetConfig} from './kernels/RotateWithOffset';
import {roundConfig} from './kernels/Round';
import {rsqrtConfig} from './kernels/Rsqrt';
import {scatterNdConfig} from './kernels/ScatterNd';
import {selectConfig} from './kernels/Select';
import {sigmoidConfig} from './kernels/Sigmoid';
import {sinConfig} from './kernels/Sin';
import {sliceConfig} from './kernels/Slice';
import
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{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
 {tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {env} from 'tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n**\n * True if threads are supported.\n\n*\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,

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11\n });\n } catch (e) {\n return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\nvar __scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :\nundefined;\n if (typeof __filename !== 'undefined') __scriptDir = __scriptDir || __filename;\n return\n(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =\n WasmBackendModuleThreadedSimd || {};\n\nfunction\nGROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAP8}function\nGROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)\n}return HEAPU8}function\nGROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)\n}return HEAP32}function\nGROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){ updateGlobalBufferAndViews(wasmMemory.buffer\n)}return HEAPU32}function\nGROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer\n)}return HEAPF64}var Module=typeof\nWasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var\nreadyPromiseResolve,readyPromiseReject;Module["ready"]=new\nPromise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var\nmoduleOverrides={ };var key;for(key in\nModule){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var arguments_=[];var\nthisProgram=("./this.program");var quit_=function(status,toThrow){throw toThrow};var\nENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var\nENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof\nwindow==="object";ENVIRONMENT_IS_WORKER=typeof\nimportScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof\nprocess.versions==="object"&&typeof\nprocess.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM\nENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var\nENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P\nTHREAD){buffer=Module["buffer"]}var scriptDirectory="";function\nlocateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return\nscriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var\nnodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").\ndirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function\nshell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=nonodePath["normalize"](filename);return\nnodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var\nret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return\nret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg\nv"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw\nex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insepct"]=function(){return"[Emscripten Module object]"};var\nnodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The\n\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw\n e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof\nread!="undefined"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var\n data;if(typeof readbuffer==="function"){return new\n Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data };if(typeof

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scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=="undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("\blob:")!==""){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\^")+1)}else{scriptDirectory=""}}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("\fs");if(!nodePath)nodePath=require("\path");filename=n
odePath["normalize\"](filename);return
nodeFS["readFileSync\"](filename,binary?null:\utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="\arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{}if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("\perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("\no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"\Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={\string":function(str){var
ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var

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numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++
]=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a

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ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].length)
){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](run
Dependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch=="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(--numWorkersToLoad)removeRunDependency("wasm-
instantiate")})})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("wasm-instantiate")}}function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return

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WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: \" +reason);abort(reason)}}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \" +reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \" +e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENODIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSIG:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"__emscripten_futex_wake\"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio

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n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! cancelThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`Internal Error! Null pthread_ptr in
cancelThread!\`;var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd\`:\`cancel\`"})function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\`Internal Error! cleanupThread() can only
ever be called from main application thread!\`;if(!pthread_ptr)throw\`Internal Error! Null pthread_ptr in
cleanupThread!\`;var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);__emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\`:\`exit\`"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\`:\`cancelDone\`"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker pthread)PThread.currentProxiedOperationCallerThread=worker pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.threads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that

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thread no longer
exists!)})PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\processQueuedMainThread
Work\"){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\spawnThread\"){spawnThread(e.data)}else
if(cmd===\cleanupThread\"){cleanupThread(d[\thread\])}else
if(cmd===\killThread\"){killThread(d[\thread\])}else
if(cmd===\cancelThread\"){cancelThread(d[\thread\])}else
if(cmd===\loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\print\"){out(\Thread \"+d[\threadId\"]+\":
\"+d[\text\])}else if(cmd===\printErr\"){err(\Thread \"+d[\threadId\"]+\": \"+d[\text\])}else
if(cmd===\alert\"){alert(\Thread \"+d[\threadId\"]+\": \"+d[\text\])}else if(cmd===\exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\exitProcess\"){try{exit(d[\returnCode\])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\setImmediate\"){worker.postMessage(e.data)}else{err(\worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\pthread sent
an error! \"+e.filename+\":\"+e.lineno+\":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\message\",function(data){worker.onmessage({data:d
ata})});worker.on(\error\",function(data){worker.onerror(data)});worker.on(\exit\",function(data){})}worker.post
Message({\cmd\":\load\",urlOrBlob\":Module[\mainScriptUrlOrBlob\]||_scriptDir,\"wasMemory\":wasMemory,
\wasModule\":wasModule}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\tfjs-
backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\unknown filename],line,func?UTF8ToString(func):\unknown
function\")}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\hrtime\]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[__performance_now_clock_drift\]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\cmd\":\processQueuedMainThreadWork\})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\targetThread\":targetThreadId,\cmd\":\processThreadQueue
\})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\cmd\":\processThreadQueue\})}ret

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urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen

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ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return"";if(target==window)return"#window";
if(target==screen)return"#screen";return
target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas);GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr

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ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return 1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return

```

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source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="\undefined"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents==="\object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)==="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var

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buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iov,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(5,1,fd,iov,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iovcnt+i*8>>2];var len=GROWABLE_HEAP_I32()[iovcnt+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! spawnThread()
can only ever be called from main application thread!`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw`Internal
error!`;if(!threadParams.pthread_ptr)throw`Internal error, no pthread
ptr!`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;+i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={`cmd\`:`run`,`start_routine\`:threadParams.startRoutine,`arg\`:threadParams.arg,`threadInfoStruct\`:thre
adParams.pthread_ptr,`stackBase\`:threadParams.stackBase,`stackSize\`:threadParams.stackSize};worker.runPthr
ead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===`undefined`){err(`Current
environment does not support SharedArrayBuffer, pthreads are not available!`);return
6}if(!pthread_ptr){err(`pthread_create called with a null thread pointer!`);return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_ptr

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tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd="\spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw\Canceled!\}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread)}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!\);return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err(\PThread
\'+thread+\ is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err(\Main thread
\'+thread+\ is attempting to join to itself!\);return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\pthread_join attempted on thread
\'+thread+\, which does not point to a valid thread, or does not exist anymore!\);return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\Attempted to join thread
\'+thread+\, which was already detached!\);return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage(\cmd:\cleanupThread\", \"thread\":thread);return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function _pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var

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proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wri
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"S\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"U\"]).apply(null,arguments)};var

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_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][_"V"]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][_"W"]).apply(null,arguments);var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_" "]").apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"qa"]).apply(null,arguments)};var

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_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][\`ra\`]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][\`sa\`]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][\`ta\`]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\`ua\`]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\`va\`]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\`wa\`]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\`xa\`]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\`ya\`]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\`za\`]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][\`Aa\`]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][\`Ba\`]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][\`Ca\`]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][\`Da\`]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][\`Ea\`]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][\`Fa\`]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][\`Ga\`]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][\`Ha\`]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][\`Ia\`]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][\`Ja\`]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][\`Ka\`]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][\`La\`]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][\`Ma\`]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][\`Na\`]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][\`Oa\`]).apply(null,arguments)};var

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_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]["Pa"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]["Qa"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]["Ra"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]["Sa"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]["Ta"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]["Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]["Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]["Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]["Xa"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]["Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]["Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["_a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]["kb"]).apply(null,arguments)};var

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_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=function(){return(_emsripten_get_global
_libc=Module["_emsripten_get_global_libc"]=Module["asm"]["lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["as
m"]["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]).apply(null,arguments)};var
_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=fu
nction(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_que
ued_calls"]=Module["asm"]["ob"]).apply(null,arguments)};var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]
=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_proc
ess_queued_calls"]=Module["asm"]["pb"]).apply(null,arguments)};var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=functi
on(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread
_id"]=Module["asm"]["qb"]).apply(null,arguments)};var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_ems
ripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"]["rb"]).app
ly(null,arguments)};var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__ems
ripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"]["sb"]).apply(n
ull,arguments)};var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){retur
n(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm\
"]["tb"]).apply(null,arguments)};var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(
){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=
Module["asm"]["ub"]).apply(null,arguments)};var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_t
hread=Module["__emsripten_call_on_thread"]=Module["asm"]["vb"]).apply(null,arguments)};var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsript
en_tls_init"]=Module["asm"]["wb"]).apply(null,arguments)};var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Mod
ule["_emsripten_thread_init"]=Module["asm"]["xb"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["yb"]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm\
"]["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ab\
"]).apply(null,arguments)};var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_
limits=Module["_emsripten_stack_set_limits"]=Module["asm"]["Bb"]).apply(null,arguments)};var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"]["Cb\
"]).apply(null,arguments)};var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=1
0512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var calledRun;function

```



```

if(e.data.cmd===\"processThreadQueue\"){if(Module[\"_pthread_self\"]()){Module[\"_emscripten_current_thread_
process_queued_calls\"]()}else{err(\"worker.js received unknown command
\'+e.data.cmd);err(e.data)}}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\'+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href:___filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\", \"\nvar
WasmBackendModule = (function() {\n var _scriptId = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptId || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"^\"}else{scriptDirectory=__dirname+\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"^\"))arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"}}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\")read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\")return new
Uint8Array(readbuffer(f))data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\")arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\")arguments_=arguments;if(typeof
quit===\"function\")quit_=function(status){quit(status)}if(typeof print!=\"undefined\")if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof

```



```

printErr!=="undefined"?printErr:print } else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ } var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} } moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}} }var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue }var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue }var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} }return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var

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endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63} else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63} else {if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]((runDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort("+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinaryFile){return new
Uint8Array(wasmBinaryFile)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}}catch(err){abort(err)}}function

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```

getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)}})else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)}})function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\")addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return {}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iocnt,pnum){var num=0;for(var
i=0;i<iocnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _pthread_join(){return 28}function

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setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument

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s));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["V"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["W"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["Y"]]).apply(null,arguments)};var

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nts));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["_"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,ar

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guments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][["Fa"]]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][["Ga"]]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][["Ha"]]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][["Ia"]]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][["Ja"]]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][["Ka"]]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][["La"]]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][["Ma"]]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][["Na"]]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][["Oa"]]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][["Pa"]]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][["Qa"]]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][["Ra"]]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"])=

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Module["asm"]["Sa"].apply(null,arguments);var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["Ta"]).apply(null,arguments);var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["Ua"]).apply(null,arguments);var
___errno_location=Module["__errno_location"]=function(){return(___errno_location=Module["__errno_location"]=Module["asm"]["Va"]).apply(null,arguments);var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["Wa"]).apply(null,arguments);var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]["Xa"]).apply(null,arguments);var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"]).apply(null,arguments);Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+"");this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"](""),1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n

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this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return\n this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =\n util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:\n DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n }\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *\n util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values\n as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\n this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData` */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():\n 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:\n false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this\n * method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated\n * elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:\n number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset\n == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =\n this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const\n {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new\n Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new\n Uint8Array(buffer, memoryOffset,\n size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n\nfunction\n createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n }\n\n\n /**\n * Returns the path of the WASM binary.\n * @param

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simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\nfunction getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return\n wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&\n threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =\n 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n }\n return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm\n module and creates the js <--> wasm bridge.\n *\n * NOTE: We wrap the wasm module in a object with property\n 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in\n Chrome 76).\n */\nexport async function init(): Promise<{ wasm: BackendWasmModule}> {\n const\n [simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>\n {\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten\n module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param\n prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new\n Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n if\n (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix\n + path;\n };\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //\n https://github.com/emscripten-\n core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7fecfa907/tests/manual_wasm_instantiate.html#L170\n if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as\n boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to\n double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double\n error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the\n server can serve the `.wasm` file relative to the ' +\n 'bundled js file. For more details see\n https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n reject({message: rejectMsg});\n };\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has\n been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath ==\n null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [\n var WasmBackendModuleThreadedSimd =\n +\n wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'};\n],\n wasm =\n wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD\n binaries.\n wasm = wasmFactory(factoryConfig);\n }\n // The WASM module has been successfully\n created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n const voidReturnType: string =\n null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:\n module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,\n [number]),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:\n module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n],\n disposeData: module.cwrap('dispose_data', voidReturnType,\n [number]),\n dispose: module.cwrap('dispose', voidReturnType, []),\n });\n resolve({ wasm: module });\n });\n }\n }\n)\n}\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):\n backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case\n 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n
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throw new Error(`Unknown dtype ${dtype}`);
}
}
const wasmBinaryNames = ['tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm', 'tfjs-backend-wasm-threaded-simd.wasm'] as const;
type WasmBinaryName = typeof wasmBinaryNames[number];
let wasmPath: string = null;
let wasmPathPrefix: string = null;
let wasmFileMap: {[key in WasmBinaryName]?: string} = {};
let initAborted = false;
let customFetch = false;
/**
 * @deprecated Use `setWasmPaths` instead.
 * Sets the path to the `.wasm` file which will be fetched when the wasm backend is initialized. See https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers for more details.
 * @param path wasm file path or url
 * @param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.
 */
@doc {heading: 'Environment', namespace: 'wasm'}
export function setWasmPath(path: string, usePlatformFetch = false): void {
 deprecationWarn('setWasmPath has been deprecated in favor of setWasmPaths and ' + path + ' will be removed in a future release.')(initAborted) {
 throw new Error(`The WASM backend was already initialized. Make sure you call ' + path + 'setWasmPath()' before you call 'tf.setBackend()' or 'tf.ready()'`);
 }
 wasmPath = path;
 customFetch = usePlatformFetch;
}
/**
 * Configures the locations of the WASM binaries.
 */
export function setWasmPaths({
 'tfjs-backend-wasm.wasm': 'renamed.wasm',
 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',
 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'
}): void {
 tf.setBackend('wasm');
}
/**
 * @param prefixOrFileMap This can be either a string or object.
 * - (string) The path to the directory where the WASM binaries are located. Note that this prefix will be used to load each binary (vanilla, SIMD-enabled, threading-enabled, etc.).
 * - (object) Mapping from names of WASM binaries to custom full paths specifying the locations of those binaries. This is useful if your WASM binaries are not all located in the same directory, or if your WASM binaries have been renamed.
 * @param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.
 */
@doc {heading: 'Environment', namespace: 'wasm'}
export function setWasmPaths(prefixOrFileMap: string | {[key in WasmBinaryName]?: string}, usePlatformFetch = false): void {
 if (initAborted) {
 throw new Error(`The WASM backend was already initialized. Make sure you call ' + prefixOrFileMap + 'setWasmPaths()' before you call 'tf.setBackend()' or ' + prefixOrFileMap + 'tf.ready()'`);
 }
 if (typeof prefixOrFileMap === 'string') {
 wasmPathPrefix = prefixOrFileMap;
 } else {
 wasmFileMap = prefixOrFileMap;
 const missingPaths = wasmBinaryNames.filter(name => wasmFileMap[name] == null);
 if (missingPaths.length > 0) {
 throw new Error(`There were no entries found for the following binaries: ` + missingPaths.join(',') + `. Please either call setWasmPaths with a ` + prefixOrFileMap + `map providing a path for each binary, or with a string indicating ` + prefixOrFileMap + `the directory where all the binaries can be found.``);
 }
 }
 customFetch = usePlatformFetch;
}
/**
 * Used in unit tests.
 */
export function resetWasmPath(): void {
 wasmPath = null;
 wasmPathPrefix = null;
 wasmFileMap = {};
 customFetch = false;
 initAborted = false;
}
let threadsCount = -1;
let actualThreadsCount = -1;
/**
 * Sets the number of threads that will be used by XNNPACK to create threadpool (default to the number of logical CPU cores).
 * This must be called before calling 'tf.setBackend('wasm')'.
 */
export function setThreadsCount(numThreads: number) {
 threadsCount = numThreads;
}
/**
 * Gets the actual threads count that is used by XNNPACK.
 * It is set after the backend is initialized.
 */
export function getThreadsCount(): number {
 if (actualThreadsCount === -1) {
 throw new Error(`WASM backend not initialized.`);
 }
 return actualThreadsCount;
}
/**
 * @license See the LICENSE file.
 * This code is auto-generated, do not modify this file!
 */
const version = '3.11.0';
export {version};
/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and limitations under the License.
 */
=====

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*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n},
WASM_PRIORITY);\n"], "names":["_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup",
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"StridedSlice", "Sub", "Sum", "Tan", "Tanh", "Tile", "TopK", "Transform", "Unpack", "ZerosLike", "registerKernel", "env"
, "require$$0", "require$$1", "require$$2", "global", "require$$3", "require$$4", "KernelBackend", "DataStorage", "engin
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CAAC;MAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;MACf,IAAI,IAAI,IAAI,IAAI,EAAE;UACHb,MAAM,QAAQ
,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;UACpD,IAAI,QAAQ,C
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AE,CAAC;OACtB;MACD,MAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;UAC3D,CAAC;UACD,OAAO,CAAC,
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B,iBAAiB,CAAC,UAAkD,CAAC,CAAC;MAC1E,IAAI,eAAe,IAAI,IAAI,EAAE;UAC3B,MAAM,IAAI,KAAC,C
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OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC;UA  
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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n\n function sum(args: { backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims('sum', reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as KernelFunc\n };\n}
```

Found in path(s):

\*/opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.js.map

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

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License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\nfunction setup(backend:
BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n}\nfunction prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs:
ProdAttrs\n}): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const
{ transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.js.map

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

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","sourcesContent":["/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sqrt.js.map

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under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
```

```
*\n\nimport { Identity, IdentityInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport
{ TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function
identity(args: { inputs: IdentityInputs, backend: BackendWasm }):\n\n TensorInfo {\n\n const { inputs: { x }, backend } =
args;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n\n const inVals = backend.typedArrayFromHeap(x);\n\n const outVals = backend.typedArrayFromHeap(out);\n\n outVals.set(inVals);\n\n return out;\n\n }\n\nexport const
identityConfig: KernelConfig = {\n\n kernelName: Identity,\n\n backendName: 'wasm',\n\n kernelFunc: identity as { } as
KernelFunc,\n\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.js.map

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

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```









```

const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\nconst filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend DepthwiseConv2dNative
does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n"}

```

Found in path(s):

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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AC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Round.js.map

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

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{"version":3,"file":"Relu.js","sourceRoot":"","sources":["../../src/kernels/Relu.ts"],"names":[],"mappings":"AAAA;:
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","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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```

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```
=====\n*\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js.map

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

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```

```

null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis,
backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {transpose} from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose

```





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```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.js.map

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

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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n\n function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend } = args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' }});\n inputId =\n
```



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 the specific language governing permissions and\n \* limitations under the License.\n \*/



```

=====
*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { FusibleActivation } from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n }) {\n const { inputs, attrs, backend } = args;\n const { x, filter, bias,
preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
 dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
 pad, dimRoundingMode, true /* depthwise */);\n const fusedActivation =\n FusibleActivation[activation as]\n as key of type of FusibleActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation}\n
activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
outputChannels = convInfo.outChannels;\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n
 if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias shape\n
(${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels}).`);\n }\n
 biasId = biasData.id;\n }\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support\n
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n wasmFusedDepthwiseConv2d(\n xId, batchSize,\n inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,\n isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n return out;\n }\n\n export const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n };
}

```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js.map

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```
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```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n}\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const { inputs: { x }, backend, attrs: { paddings, mode } } = args;\n const outShape = paddings.map((p, i) => p[0] /*
```

```

beforePad */ + x.shape[i] + p[1] /* afterPad */);
const xId = backend.dataIdMap.get(x.dataId).id;
const out = backend.makeOutput(outShape, x.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);
const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);
const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);
const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);
const wasmMirrorPad(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes, postPaddingsBytes, MirrorPaddingMode[mode], outId);
return out;
}
export const mirrorPadConfig: KernelConfig = {
kernelName: 'MirrorPad',
backendName: 'wasm',
kernelFunc: mirrorPad as {} as KernelFunc,
setupFunc: setup;
}
}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MirrorPad.js.map

```

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

```

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,8DAA8D;AAC9D,gBAAGB;AACH,uBAAB,EAAC,KAAK,IAAI,EAAC,CAAC,WAAW,CAAC,QAAQ,CAAC,
IAAI,UAAU,CAAC;IACvE,CAAC,EAAE,EAAE,EAAE,GAAG,EAAE,GAAG,EAAE,CAAC,EAAE,CAAC,EAA
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"sourcesContent":["/*
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 */

import {env} from 'tensorflow/tfjs-core';
const ENV = env();
/**
 * True if SIMD is supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-feature-detect
ENV.registerFlag(
 // This typed array
 passed in to WebAssembly.validate is WebAssembly binary
 // code. In this case it is a small program that
 contains SIMD
 // instructions.
 'WASM_HAS_SIMD_SUPPORT',
 async () => WebAssembly.validate(new
 Uint8Array([
 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,
 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
 11
]));
/**
 * True if threads are supported.
 */
// From: https://github.com/GoogleChromeLabs/wasm-

```



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\*\*\*\*\* \*/  
/\*\*

\* @deprecated Use `setWasmPaths` instead.  
\* Sets the path to the `.wasm` file which will be fetched when the wasm

```

* backend is initialized. See
* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
* for more details.
* @param path wasm file path or url
* @param usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/miniprogram/index.js

```

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

```

{"version":3,"file":"FloorDiv.js","sourceRoot":"","sources":["../../src/kernels/FloorDiv.ts"],"names":[],"mappings":"
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MAAM,cAAc,GACvB,wBAAwB,CAAC,QAAQ,EAAE,qBAAqB,CAAC,CAAC","sourcesContent":["/**\n *
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=====
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"]}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js.map

```

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```

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AAS,GACIB,wBAAwB,CAAC,GAAG,EAAE,qBAAqB,CAAC,CAAC","sourcesContent":["/**\n * @license\n *
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=====
\n"]}

```

```
*\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\ncreateBinaryKernelConfig(Sub, supportsFullBroadcast);\n"]}
```

Found in path(s):

`/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.js.map`

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 * =====
 */
```

Found in path(s):

`/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.js`

`/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.d.ts`

`/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/kernel_utils.ts`

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```
=====\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:\n KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {\n } as KernelFunc,\n setupFunc: setup\n};\n\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js.map

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

```
{"version":3,"file":"Elu.js","sourceRoot":"","sources":["../src/kernels/Elu.ts"],"names":[],"mappings":"AAAA;;;;;GAeG;AACH,OAAO,EAAE,GAAG,EAAe,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAE,uBAAuB,EAA C,MAAM,gBAAgB,CAAC;AAEvD,MAAM,CAAC,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from '../unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.js.map

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

```
{"version":3,"file":"Neg.js","sourceRoot":"","sources":["../src/kernels/Neg.ts"],"names":[],"mappings":"AAAA;;;GAeG;AACH,OAAO,EAAE,GAAG,EAAE,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAE,uBAAuB,EA
```

AC,MAAM,gBAAGB,CAAC;AACvD,MAAM,CAAC,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC,CAAC", "sourcesContent":["/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js.map

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

```
{"version":3,"file":"Sin.js","sourceRoot":"","sources":["../src/kernels/Sin.ts"],"names":[],"mappings":"AAAA;:::;;GAG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAGB,CAAC;AACvD,MAAM,CAAC,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC,CAAC", "sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.js.map

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

```
{"version":3,"file":"Square.js","sourceRoot":"","sources":["../src/kernels/Square.ts"],"names":[],"mappings":"AAAA;:::;;GAG;AACH,OAAO,EAAe,MAAM,EAAC,MAAM,uBAAuB,CAAC;AAE3D,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAGB,CAAC;AACvD,MAAM,CAAC,MAAM,YAAY,GAAiB,uBAAuB,CAAC,MAAM,CAAC,CAAC", "sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
```

```
./unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.js.map
```

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

```
{"version":3,"file":"Minimum.js","sourceRoot":"","sources":["../../src/kernels/Minimum.ts"],"names":[],"mappings":":AAAA;,,,,,GAeG;AACH,OAAO,EAAe,OAAO,EAAC,MAAM,uBAAuB,CAAC;AAE5D,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,aAAa,GACTb,wBAAwB,CAAC,OAAO,EAAE,qBAAqB,CAAC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n *\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js.map
```

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

```
{"version":3,"file":"Tan.js","sourceRoot":"","sources":["../../src/kernels/Tan.ts"],"names":[],"mappings":":AAAA;,,,,,GAeG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAAC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,SAAS,GAaiB,uBAAuB,CAAC,GAAG,CAAC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n *\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tan.js.map
```

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

```
{"version":3,"file":"PadV2.js","sourceRoot":"","sources":["../../src/kernels/PadV2.ts"],"names":[],"mappings":":AA
AA;,,,,,GAeG;AAEH,OAAO,EAA2B,KAAK,EAA2B,IAAI,EAAC,MAAM,uBAAuB,CAAC;AAIrG,OAAO
```



```
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new\n Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,\n CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;}\n\nexport\n const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as\n KernelFunc,\n setupFunc: setup\n};\n"]}
```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.js.map

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```
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```

Found in path(s):

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup\_test.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/RotateWithOffset.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LogicalAnd.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cast.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/RealDiv.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Minimum.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Max.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/\_FusedMatMul.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sub.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Min.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LeakyRelu.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary\_kernel.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.js

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Greater.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Add.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/binary\_kernel.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.d.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sigmoid.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherNd.ts

\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-

wasm/dist/kernels/BatchMatMul.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV3.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Exp.js  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppressionV5.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Cos.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/AddN.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Log.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/FusedConv2D.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/LeakyRelu.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.d.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Tanh.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary\_kernel.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/index.ts  
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\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/SquaredDifference.ts  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index\_test.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js  
\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.d.ts



\* /opt/cola/permits/1234600203\_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.d.ts  
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No license file was found, but licenses were detected in source scan.

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]
}
```

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```
=====\n
*\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ reshape } from './Reshape';\n\nimport { slice } from './Slice';\n\nimport { transpose } from './Transpose';\n\nfunction
batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
crops} = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted =
backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\nbackend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\nbackend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\nbackend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n
attrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n
backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as KernelFunc\n};\n\n}}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchToSpaceND.js.map
```

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

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```

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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n
'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n
'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', //
leakyreluAlpha\n 'number' // out_id\n]);\n\nfunction fusedBatchMatMul(args: {\n inputs:
_FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n}) {\n const {inputs, backend,\n attrs} = args;\n const {a, b, bias, preluActivationWeights} = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !==
'float32') {\n throw new Error(\n ` _FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const {transposeA, transposeB, activation, leakyreluAlpha} = attrs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if
(bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n ` _FusedMatMul only supports rank-1 bias but got ` +\n `rank
${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId =
```

```

preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const
fusedActivation =\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if
(fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for
FusedConv2D` +\n ` in the wasm backend.`);\n };\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n
const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out =
backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
 wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return {kernelName, backendName: 'wasm',
setupFunc, kernelFunc};\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations 0 under the License.\n *
=====\n
*/\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
../unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport

```



```

function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:\n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}):\n TensorInfo {\n const {backend,\n inputs} = args;\n const {a, b} = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =\n backend.dataIdMap.get(b.dataId).id;\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =\n backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,\n outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return\n out;\n }\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =\n new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some float operations support full broadcast.\n if\n (supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n\n const\n aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =\n backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>\n v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&\n loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting\n along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n\n return\n {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n }\n\n /**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *

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```

```

const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:
AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as {} as
KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'./Identity';\n\nimport {CppType} from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,
xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /*
void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n
'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n}\n\nexport function transpose(\n args:\n {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):\n TensorInfo {\n const {inputs,
backend, attrs} = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better
due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,
attrs.perm);\n\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n
permIsNoOp = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n
dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n};\n\n if (permIsNoOp) {\n const
cloned = identity({inputs, backend});\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,\n xShapeBytes,
x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n
return outShape;\n}\n\nfunction removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]]\n
{\n const newShape: number[] = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n
if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n
newPerm.push(perm[i]);\n }\n}\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j =

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0; j < newPerm.length; ++j) {\n if (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] >
newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape,
newPerm];\n}\n\nexport const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName:
'wasm',\n kernelFunc: transpose as {} as KernelFunc,\n setupFunc: setup,\n};\n\n"/**\n * @license\n * Copyright
2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\nimport { transpose } from './Transpose';\n\n/**\n * Compute permutation axes and do a transpose
if necessary.\n * Used by reduction ops.\n * @param x input TensorInfo\n * @param axis reduction axes\n *
@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis: number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n } {\n const xShape = x.shape;\n const xRank =
x.shape.length;\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let
inputWasTransposed = false;\n if (permutedAxes !== null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
}\n }\n\n return {transposed: xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n"/**\n * @license\n *
Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null
/*void*/, ['number, number, number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs:
AllAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x}
= inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const
{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n
backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =

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backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n
const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n
const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis,
backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n
input = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n
backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'./kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, outerSize:
number, innerSize: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n
'number', // outer_size\n 'number', // inner_size\n 'number' // out_id\n]);\n}\n\nfunction argmax(\n args:
{ inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n const { backend, inputs, attrs } = args;\n
const { axis } = attrs as {} as ArgMaxAttrs;\n const { x } = inputs as {} as ArgMaxInputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose
was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =

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transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out =
backend.makeOutput(outShape, 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize =
util.sizeFromShape(out.shape);\n const innerSize = input.shape[axes[0]];\n wasmFunc(inputId,
CppType[input.dtype], outerSize, innerSize, outId);\n\n if (inputWasTransposed) {\n // dispose of the
transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n}\n\nexport const
argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName: 'wasm',\n kernelFunc: argmax as { }
as KernelFunc,\n setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs,
backend } = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const
{ filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n
const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n
`wasm backend does not support dataFormat: ` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n
}\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new Error(\n `was backend
only supports average pooling with dilation = [1, 1],`\n `got [${convInfo.dilationHeight},\n
${convInfo.dilationWidth}].`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: avgPool as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n args: { inputs:

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ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm)) {\n const {inputs, attrs} = args;\n const {x} =
inputs;\n const {shape} = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old `+\n `shape must have the same number of
elements.`);\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incref(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as {} as KernelFunc\n};\n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n}\n\nfunction batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const {transposeA, transposeB} = attrs;\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n `BatchMatMul for non float32 tensors not yet supported.`);\n }\n const aRank = a.shape.length;\n const bRank = b.shape.length;\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n const batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input batch dimensions must either be the `+\n `same or at least one input batch dimension must be 1. Got input `+\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n const outShapeOuterDims =\n batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and `+\n ` ${innerShapeB} of Tensors with shapes ${a.shape} and `+\n ` ${b.shape} and transposeA=${transposeA} `+\n ` and transposeB=${transposeB} must match.`);\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,\n innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n // The rest of the implementation is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n const a3dId = backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const batchDim = Math.max(batchDimA, batchDimB);\n const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new

```

















kernelFunc: cast as { } as KernelFunc;\n};\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', // max\n 'number' // out_id\n]);\n function clip(args: {\n inputs: ClipByValueInputs,\n backend: BackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n export const clipByValueConfig: KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as { } as KernelFunc\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {concatImplCPU} from './kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\nexport function concat(\n args: {\n inputs: ConcatInputs,\n backend: BackendWasm,\n attrs: ConcatAttrs\n }) {\n const {inputs, backend} = args;\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length === 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n const out = backend.makeOutput(outShape, inputs[0].dtype);\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n const shapes = $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n if ($inputs[0].dtype === 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than\n // axis to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by
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collapsing these two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat =
inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,
inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n const
outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n
return out;\n })\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b <
batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n }\n return
out;\n }\n\nexport const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName: 'wasm',\n
kernelFunc: concat as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n 'number', // xId\n
'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n
'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n
'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n
'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n
'number', // outputChannels\n 'number', // outId\n]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend:
BackendWasm, attrs: Conv2DAttrs}) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =

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convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
Conv2D does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n }\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: 'Conv2D',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //
outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number',
// fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n]);\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const { backend, inputs, attrs } = args;\n const { dy, filter } = inputs;\n const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n const dilations = 1;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,

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cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n
InterpolationMethod[method as { } as keyof typeof InterpolationMethod],\n extrapolationValue, outId);\n\n if
(castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\n\nexport const
cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: cropAndResize as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from
 './types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n]);\n}\n\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs});\n\nTensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype === 'float32' || x.dtype ===
'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis
to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n
if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n
const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n
const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as
KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number', // channelsLast\n 'array', // xStrides\n
'number', // xStridesLength\n 'array', // outputShape\n 'array', // outputStrides\n 'number', // outSize\n
'number', // outId\n]);\n\n export function depthToSpace(args: {\n backend: BackendWasm,\n inputs:
DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n }\n\n export const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n };}\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /*void*/, [\n 'number', //
xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', //
filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', //
padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', //
dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n }) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n
const
{strides, dilations, pad, dimRoundingMode} = attrs;\n\n const $dilations = dilations == null ? [1, 1] : dilations;\n\n

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const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides,\n ($dilations as number | [number, number]), pad, dimRoundingMode,\n true /* depthwise */);\n\nconst filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n\nconst padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend DepthwiseConv2dNative
does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n } \n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\nwasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n outputChannels, outId);\n return out;\n);\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n=====\n\n*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
\n\n=====\n\n*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n=====\n\n*/\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *

```

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```
=====\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs: ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: BackendWasm\n}) {\n const {inputs, attrs, backend} = args;\n const {input} = inputs;\n const {dim} = attrs;\n const inputRank = input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`);\n $dim = inputRank + dim + 1;\n }\n newShape.splice($dim, 0, 1);\n return reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n backendName: 'wasm',\n kernelFunc: expandDims as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {\n const {attrs: {shape, value, dtype}, backend} = args;\n const out = backend.makeOutput(shape, dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(value as number);\n return out;\n}\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'wasm',\n kernelFunc: fill as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {} as KernelFunc,\n setupFunc: setup\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n */\n
```



```

*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,
padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,
dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n
inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number,
leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n
'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n
'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', //
preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const
{strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } =
attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as
Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n
FusableActivation[activation as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n
throw new Error(\n ` ${activation} activation not yet supported for FusedConv2D ` +\n ` in the wasm backend.`);\n
}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if
(bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n
throw new Error(\n `FusedConv2D only supports rank-1 bias but got ` +\n `rank
${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels
(${outputChannels}).`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n ` ${dataFormat}. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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```

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```
=====\n*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n }) {\n const { inputs, attrs, backend } = args;\n const { x, filter, bias, preluActivationWeights } = inputs;\n const { strides, pad, dilations, dataFormat, dimRoundingMode, activation, leakyreluAlpha } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation = FusibleActivation[activation as {} as keyof typeof FusibleActivation];\n if (fusedActivation == null) {\n throw new Error(` ${activation} activation not yet supported for FusedDepthwiseConv2D ` +\n `in the wasm backend.`);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(`FusedDepthwiseConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output channels (${outputChannels}).`);\n }\n\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(` wasm backend FusedDepthwiseConv2D does not support dataFormat: ` +\n `${dataFormat}'. Please use 'NHWC'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const preluActivationWeightsId = preluActivationWeights == null ? 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
```



```
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport { gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n
'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args: { backend: BackendWasm,
inputs: GatherNdInputs }):\n TensorInfo {\n const { backend, inputs } = args;\n const { params, indices } =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n", "/*\n * @license\n
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* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
* http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { reshape } from './Reshape';\n\nimport { CppDType } from './types';\n\nlet
wasmGather: (\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n
'array', // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n
'array', // outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: { backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { x,
indices } = inputs;\n const { axis, batchDims } = attrs;\n\n // Throw error when any index is out of bound.\n const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const index
= indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]);\n }\n\n const shapeInfo =
```

```

backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,\n shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n },\n backend\n });\n const
indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const flattenOutputShape =
[\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n
const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const xData =
backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n }\n\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/**\n
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/**\n
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n", "/**\n
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from
'/types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,

```

```

null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n\nexport function leakyRelu(\n args:\n {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc,\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:\n number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function max(args: {backend:\n BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,\n inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',\n axes, inputRank);\n\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if (\n util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the\n transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
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```
=====\n*\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
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=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\n from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmMaxPool: (\n xId:\n number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:\n number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
```



```

reductionAxes, input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const meanConfig:
KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as { }
as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n
'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction min(args: {backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs}):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
let\n inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('min', axes,
inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape,
input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n
kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as { } as\n KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n

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*\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
 xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
 Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
 setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n
 'array', // pre-
 paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n}\n\nfunction
 mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const
 {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /*
 beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(outShape, x.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
 xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
 paddings.map(padTuple => padTuple[0]);\n\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
 const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n const
 postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
 xId, xShapeBytes, x.shape.length, CCppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
 MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
 kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as KernelFunc,\n setupFunc:
 setup\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

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=====\n
*\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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```

=====\n
*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from

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./unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in\n`non_max_suppression_impl.h`\n\ninterface Result {\n pSelectedIndices: number;\n selectedSize: number;\n pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the\n * shape equivalent to\n * `Result`\n */\n\nexport function parseResultStruct(\n backend: BackendWasm, resOffset:\n number): Result {\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const\n pSelectedIndices = result[0];\n const selectedSize = result[1];\n const pSelectedScores = result[2];\n const\n pValidOutputs = result[3];\n // Since the result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return {pSelectedIndices, selectedSize, pSelectedScores,\n pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under\n * the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,\n NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from\n './backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)\n=> number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n]);\n}\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs:\n NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,\n maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} = inputs;\n const boxesId =\n backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const\n resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n const\n {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V3, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor\n =\n backend.makeOutput([selectedSize, 'int32'], pSelectedIndices);\n return\n selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:\n NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {\n } as\n KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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=====\n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n}\n\nfunction nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as }\n as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
```

```
=====\n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n\n}\n\nfunction kernelFunc(args: {\n backend:
BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[]
{\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma
} =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const
scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId,
maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using
validOutputs for V5, we have to delete it from the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const
selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return
[selectedIndicesTensor, selectedScoresTensor];\n\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
```

```
{\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc
as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmOneHot: (\n indicesId: number, depth:
number, onValue: number, offValue: number,\n outId: number) => void;\nfunction setup(backend:
BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n}\nfunction
oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs,
backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n return out;\n}\nexport const oneHotConfig:
KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
{ } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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```
=====\n*\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.fill(1);\n return out;\n}\nexport const
onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as
{ } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
```

implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {concat} from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape, \n 'All tensors passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype, \n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t =>\n backend.disposeData(t.dataId));\n\n return result;\n }\n\nexport const packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc;\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====\n*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {fill} from './Fill';\nimport {CppType} from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null\n/* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend, \n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as KernelFunc,\n setupFunc: setup;\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n return out;\n }\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as KernelFunc\n }; \n}"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\nlet wasmProd: (\n xId: number, reduceSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape,
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reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize
= util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of
the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n
return out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const
range =\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } =
args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n
const out = backend.makeOutput([values.length], dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\nexport const rangeConfig:
KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n", "/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {cast} from
'./Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n\nfunction
resizeBilinear(args: {\n backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {images} = inputs;\n const {alignCorners,
halfPixelCenters, size} = attrs;\n const [newHeight, newWidth] = size;\n const [batch, oldHeight, oldWidth,
numChannels] = images.shape;\n const outShape = [batch, newHeight, newWidth, numChannels];\n let xData =
backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n castedData =\n
cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n xData =
backend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n const out =
backend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n
const outId = backend.dataIdMap.get(out.dataId).id;\n wasmResizeBilinear(\n xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from
'./Identity';\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes: Uint8Array,
axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n
'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', // out_shape_length\n
'number' // out_id\n]);\n\nexport function reverse(\n args: {\n inputs: ReverseInputs, backend: BackendWasm, attrs:
ReverseAttrs\n }):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} =
attrs;\n const axes = util.parseAxisParam(dims, x.shape);\n if (x.shape.length === 0) {\n return
identity({inputs: {x}, backend});\n }\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId =

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backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const axesBytes =
new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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=====\n
*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:
number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', //
radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n
'number', // outId\n]);\n\nexport function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n
backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n\n const out =
backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight,
imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const fullOpacityValue = 255;\n const fillValues =
typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n
[...fillValue, fullOpacityValue];\n const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n
wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n centerY,
fillBytes, fillValues.length, outId);\n return out;\n}\n\nexport const rotateWithOffsetConfig: KernelConfig = {\n
kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n
setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n *
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```
=====\n\n*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n\n*\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppDType} from './types';\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CppDType, sliceRank: number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', // sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n function scatterNd(\n args: {\n backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n const out = backend.makeOutput(shape, updates.dtype);\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n const {sliceRank, numUpdates, sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const updatesData = backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmScatterNd(\n indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n sliceSize, stridesBytes, outputSize, outId);\n return out;\n }\n export const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as KernelFunc\n };}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet wasmSelect: (\n conditionId: number, tId: number, eId: number, offset: number,\n outId: number) => void;\nfunction setup(backend: BackendWasm) {\n wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n 'number', // conditionId\n 'number', // tId\n 'number', // eId\n 'number', // offset\n 'number', // outId\n]);\n function select(args: {inputs: SelectInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n const conditionId = backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId = backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const cRank = condition.shape.length;\n const tRank = t.shape.length;\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n 1 : 0;\n }\n}
```



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util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset, outId);\n return out;\n}\n\nexport
const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'wasm',\n kernelFunc: select as { }
as KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n
TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
= backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId,
outId);\n return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: 'Sigmoid',\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n
waswFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n]);\n}\n\nfunction softmax(\n args: { backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if
(util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {padV2Config} from
 './PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:
SpaceToBatchNDAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape,
padding} = attrs;\n const prod = util.sizeFromShape(blockShape);\n const completePaddings: Array<[number,
number]> = [[0, 0]];\n completePaddings.push(...(padding as Array<[number, number]>));\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n const paddedX =
padV2Config.kernelFunc({\n inputs: {x},\n backend,\n attrs: {padding: completePaddings, constantValue:
0}\n}) as TensorInfo;\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape,
blockShape, prod, false);\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length, blockShape.length, false);\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n const reshapeInputs:
ReshapeInputs = {x: paddedX};\n const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n const
paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n const transposeInputs:
TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n backend.disposeData(paddedX.dataId);\n backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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 the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs, attrs, backend} = args;\n const {x} = inputs;\n const
{numOrSizeSplits, axis} = attrs;\n const $axis = util.parseAxisParam(axis, x.shape)[0];\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] =
s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName:
'wasm',\n kernelFunc: splitV as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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```
=====\n*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
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=====\n*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }\n from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig\n =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright\n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-\n core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nlet wasmStep:\n (xId: number, alpha: number, dtype: number, outId: number) => void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction step(\n args: {\n backend:\n BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { alpha } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n return wasmStep(xId,\n alpha,\n CppDType[x.dtype],\n outId);\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName:\n Step,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: step as {} as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport\n { permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmSum: (xId:\n number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n 'number', // reduce_size\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction sum(args: { backend:\n BackendWasm, inputs: SumInputs, attrs: SumAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let\n inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes, inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const\n transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was\n not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =\n transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,\n input.shape.length);\n }\n }\n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,\n input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport { KernelConfig, Tan } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport { KernelConfig, Tanh } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
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governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape : [imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n const strides =\n new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\n export const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: transform as {\n kernelFunc\n } as KernelFunc\n };\n}\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { slice } from './Slice';\n\nfunction unpack(\n args: {\n inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs\n }):\n TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n if (axis < 0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank = value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank; i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value }, attrs: { begin, size, backend } });\n }\n return outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n}\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as {\n kernelFunc\n } as KernelFunc\n}
```

KernelFunc,\n};\n"/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike\n} as KernelFunc;\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n//\n\nWe explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
```



```

{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
 from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
 {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
 from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
 './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
 from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
 {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
 {tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n
 argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n
 ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n
 cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n
 depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n
 flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n
 fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n
 greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n
 logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n
 minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
 nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
 onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
 realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
 rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
 sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
 squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
 tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
 zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n\n"/**\n *
 @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
 copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
 law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for

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the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\n
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n]));\n\n**\n * True if threads are supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n]));\n } catch (e) {\n return false;\n }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function) {\n
var __scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') __scriptDir = __scriptDir || __filename;\n return
(\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"] =new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram= \"/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object\"&&typeof
process.versions==="object\"&&typeof
process.versions.node==="string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
```

```

nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\\\"/\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error(\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print} else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !== \"undefined\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\\\"/\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret} }else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\"undefined\"){global.performance=require(\"perf_hooks\").performance} }var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)} }var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var

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wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function '"+ident+"', make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new

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Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function

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getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"}return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)}})else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)}})function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSYS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14

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8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw`Atomics.notify returned an unexpected value
`+ret}Module["_emscripten_futex_wake"]=__emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! killThread() can only ever be
called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
killThread!`;GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cancelThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cancelThread!`;var
pthread=PThread pthreads[pthread_ptr];pthread.worker.postMessage({"cmd\":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw`Internal Error! cleanupThread() can only
ever be called from main application thread!`;if(!pthread_ptr)throw`Internal Error! Null pthread_ptr in
cleanupThread!`;var
pthread=PThread pthreads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb),initWorker:function(){},pthreads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=__pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone"})}},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh

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readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread pthreads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker pthread)PThread.currentProxiedOperationCallerThread=worker pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"])}else
if(cmd===\'killThread\'){killThread(d["thread"])}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"])}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\'print\'){out("Thread \"+d["threadId"]+"":
'+d["text"])}else if(cmd===\'printErr\'){err("Thread \"+d["threadId"]+"": '+d["text"])}else
if(cmd===\'alert\'){alert("Thread \"+d["threadId"]+"": '+d["text"])}else if(cmd===\'exit\'){var
detached=worker pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\'setImmediate\'){worker.postMessage(e.data)}else{err("worker sent an unknown command
'+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! \"+e.filename+"":'+e.lineno+":
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
ata}});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
Message({"cmd":\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]|_scriptDir,"wasmMemory\':wasmMe
memory,\"wasmModule\':wasmModule}},allocateUnusedWorker:function(){var pthreadMainJs=locateFile("tfjs-
backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){__emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function

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__assert_fail(condition,filename,line,func){abort("\Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emsripten_get_now;if(ENVIRONMENT_IS_NODE){_emsripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emsripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emsripten_get_now=dateNow}else _emsripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emsripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\": \"processThreadQueu
e\"})}else {var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\": \"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emsripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emsripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emsripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atomics.wait returned an unexpected value
\"+ret}else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emsripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr)}return
0}}function
_emsripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function _emsripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){_emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v

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ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListe
ners:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f

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unction(targetThread){switch(targetThread){case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n _emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension(\"ANGLE_instanced_arrays\");if(ext){ctx[\"vertexAttribDivisor\"]=function(index,divisor){ex
t[\"vertexAttribDivisorANGLE\"](index,divisor)};ctx[\"drawArraysInstanced\"]=function(mode,first,count,primcou
nt){ext[\"drawArraysInstancedANGLE\"](mode,first,count,primcount)};ctx[\"drawElementsInstanced\"]=function(
mode,count,type,indices,primcount){ext[\"drawElementsInstancedANGLE\"](mode,count,type,indices,primcount)};

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return 1 } }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();}; ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao);};
ctx["bindVertexArray"]=function(vao){ ext["bindVertexArrayOES"](vao);}; ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao);};return 1 } }function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ ctx["drawBuffers"]=function(n,bufs){ ext["drawBuffers
WEBGL"](n,bufs);};return 1 } }function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))} }var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null }return
ret },getSource:function(shader,count,string,length){ var source="" ;for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len) }return
source },createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle },registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context) }return
handle },makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx) },getContext:function(c
ontextHandle){ return
GL.contexts[contextHandle] },deleteContext:function(contextHandle){ if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined)JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null },initExtensions:f
unction(context){ if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){ if(ext.indexOf("lose_context")<0&&ext.inde
xOf("debug")<0){ GLctx.getExtension(ext) } } },populateUniformTable:function(program){ var
p=GL.programs[program];var
ptable=GL.programInfos[program]={ uniforms:{ },maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1 };var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){ var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){ name=name.slice(0,name.lastIndexOf("\\")) } var loc=GLctx.getUniformLocation(p,name);if(loc){ var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){ var

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n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc }}
});var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
__pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=__emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr

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ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":theadParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded){worker.runPthead();delete worker.runPthead}}function
__pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current environment does not support SharedArrayBuffer, pthreads are not available!\\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\\");return 28}var transferList=[];var error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
__emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var i=0;i<228>>2;+i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_ptr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_PTHREAD){threadParams.cmd=\\\"spawnThread\\\";postMessage(threadParams,transferList)}else{spawnThread(threadParams)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var tb=__pthread_self();if(!tb)return;var cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\"}function __emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKER)return;warnOnce(\\"Blocking on the main thread is very dangerous, see https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\")}function __emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread pointer!\\");return ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\\"PThread \"+thread+\\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}else if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()===thread){err(\\"Main thread \"+thread+\\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}var self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread \"+thread+\\\", which does not point to a valid thread, or does not exist anymore!\\");return ERRNO_CODES.ESRCH}var detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\\"Attempted to join thread \"+thread+\\\", which was already detached!\\");return ERRNO_CODES.EINVAL}if(block){__emscripten_check_blocking_allowed()}for(;;){var threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[status>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PTHREAD)cleanupThread(thread);else postMessage({\\"cmd\\":\\"cleanupThread\\",\\"thread\\":thread});return 0}if(!block){return ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thread_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1)}}function __pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function

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_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emsripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emsripten_notify_thread_queue,\"b\":_abort,\"y\":
_emsripten_asm_const_int,\"j\":_emsripten_conditional_set_current_thread_status,\"d\":_emsripten_futex_wait,\"
c\":_emsripten_futex_wake,\"f\":_emsripten_get_now,\"p\":_emsripten_memcpy_big,\"A\":_emsripten_num_l
ogical_cores,\"u\":_emsripten_receive_on_main_thread_js,\"q\":_emsripten_resize_heap,\"v\":_emsripten_set_ca
nvas_element_size,\"i\":_emsripten_set_current_thread_status,\"s\":_emsripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var

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_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][\N]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][\O]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][\P]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][\Q]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][\R]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][\S]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][\T]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][\U]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][\V]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][\W]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][\X]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][\Y]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][\Z]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][\$]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][\aa]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][\ba]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][\ca]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][\da]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][\ea]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][\fa]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][\ga]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][\ha]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][\ia]).apply(null,arguments)};var

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_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"])[\ja"]
)}.apply(null,arguments);var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"])[\ka"]}.apply(
null,arguments);var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[
"asm"])[\la"]}.apply(null,arguments);var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"])[\
ma"]}.apply(null,arguments);var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"])[\na"]}.apply(null,argume
nts);var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"])[\o
a"]}.apply(null,arguments);var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"])[\pa"]}.apply(null,argument
s);var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"])[\qa"]}.apply(null,arguments);var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"])[\ra"]}.apply(null,argume
nts);var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"])[\sa"]}.
apply(null,arguments);var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"])[\ta
a"]}.apply(null,arguments);var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"])[\ua"]}.apply(null,ar
guments);var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"])[\va"]}.apply(null,argumen
ts);var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"])[\wa
"]}.apply(null,arguments);var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"])[\x
a"]}.apply(null,arguments);var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"])[\ya
"]}.apply(null,arguments);var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"])[\za"]}.apply(null,argumen
ts);var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"])[\Aa"]}.apply(null,arguments);var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"])[\Ba"]}.apply(null,arguments);var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"])[\Ca"]}.apply(null,arguments);var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"])[\Da
"]}.apply(null,arguments);var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"])[\Ea"]}.appl
y(null,arguments);var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"])[\Fa"]}.apply(nu
ll,arguments);var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"])[\Ga"]}.apply(null,argume
nts);var

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_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"cb"]).apply(null,arguments)};var

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 Tile=Module["_Tile"]=function(){return(Tile=Module["_Tile"]=Module["asm"][["db"]]).apply(null,argument
s)};var
 TopK=Module["_TopK"]=function(){return(TopK=Module["_TopK"]=Module["asm"][["eb"]]).apply(null,ar
guments)};var
 Transform=Module["_Transform"]=function(){return(Transform=Module["_Transform"]=Module["asm"][["f
b"]]).apply(null,arguments)};var
 Transpose=Module["_Transpose"]=function(){return(Transpose=Module["_Transpose"]=Module["asm"][["g
b"]]).apply(null,arguments)};var
 FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][["hb"]]).apply(null,arguments)};var
 malloc=Module["_malloc"]=function(){return(malloc=Module["_malloc"]=Module["asm"][["ib"]]).apply(nul
l,arguments)};var
 free=Module["_free"]=function(){return(free=Module["_free"]=Module["asm"][["jb"]]).apply(null,arguments
)};var
 __errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][["kb"]]).apply(null,arguments)};var
 emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][["lb"]]).apply(null,arguments)};var
 pthread_self=Module["_pthread_self"]=function(){return(pthread_self=Module["_pthread_self"]=Module["as
m"][["mb"]]).apply(null,arguments)};var
 __pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"][["nb"]]).apply(null,arguments)};var
 emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][["ob"]]).apply(null,arguments)};var
 emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]
=function(){return(emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["asm"][["pb"]]).apply(null,arguments)};var
 emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread
_id"]=Module["asm"][["qb"]]).apply(null,arguments)};var
 emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_ems
cripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][["rb"]]).app
ly(null,arguments)};var
 __emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__ems
cripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][["sb"]]).apply(n
ull,arguments)};var
 emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){retur
n(emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"]
)[["tb"]]).apply(null,arguments)};var
 emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(
){return(emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=
Module["asm"][["ub"]]).apply(null,arguments)};var
 emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"][["vb"]]).apply(null,arguments)};var
 emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(emscripten_tls_init=Module["_emscrip
ten_tls_init"]=Module["asm"][["wb"]]).apply(null,arguments)};var
 emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod

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e.data.urlOrBlob===\"string\") {importScripts(e.data.urlOrBlob)} else { var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()}) else
if(e.data.cmd===\"objectTransfer\") {Module[\"PThread\"].receiveObjectTransfer(e.data)} else
if(e.data.cmd===\"run\") {Module[\"__performance_now_clock_drift\"]=performance.now()-
e.data.time;Module[\"__emscripten_thread_init\"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[\"establishStackSpace\"](top,max);Module[\"_emscripten_tls_init\"](
);Module[\"PThread\"].receiveObjectTransfer(e.data);Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self
\")(0,1);try { var
result=Module[\"invokeEntryPoint\"](e.data.start_routine,e.data.arg);if(!Module[\"getNoExitRuntime\"]())Module[\"
PThread\"].threadExit(result)} catch(ex){if(ex===\"Canceled!\"){Module[\"PThread\"].threadCancel()} else
if(ex!==\"unwind\") {if(ex instanceof
Module[\"ExitStatus\"]){if(Module[\"getNoExitRuntime\"]()){} else {Module[\"PThread\"].threadExit(ex.status)}} el
se {Module[\"PThread\"].threadExit(-2);throw ex}} } else
if(e.data.cmd===\"cancel\") {if(Module[\"_pthread_self\"]()) {Module[\"PThread\"].threadCancel()} } else
if(e.data.target===\"setimmediate\") {} else
if(e.data.cmd===\"processThreadQueue\") {if(Module[\"_pthread_self\"]()) {Module[\"_emscripten_current_thread_
process_queued_calls\"]())} else {err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}} catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\") {self={location:{href: __filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\") {performance={now:function(){return Date.now()}}};\", \"\nvar
WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram= \"/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").

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dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)};readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src;if(_scriptDir){s
criptDirectory=_scriptDir;if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("^")+1)}else{scriptDirectory=""}};read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)};readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}} }var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return

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ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{ var
str="";while(idx<endPtr){ var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} }return str}function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]=u}
else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63} else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63} else {if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())} }callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){ addOnPostRun(Module["postRun"].shift())} }callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]((runDependencies))}function removeRunDependency(id){runDependencies--

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;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\function\&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
\n"+wasmBinaryFile+"\n"}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"][\j\];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"][\r\];removeRunDependency(\wasm-
instantiate\)}addRunDependency(\wasm-instantiate\);function
receiveInstantiatedSource(output){receiveInstance(output[\instance\])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\failed to asynchronously prepare
wasm: \n"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\wasm streaming compile failed: \n"+reason);err(\falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err(\Module.instantiateWasm
callback failed with error: \n"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg
)}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return

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1 }catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4]>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iiov,iiovcnt,pnum){var num=0;for(var
i=0;i<iiovcnt;i++){var ptr=HEAP32[iiov+i*8>>2];var len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _thread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_thread_create,\"g\":_thread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments

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});var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"]["t"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"]["u"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"]["v"]).apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]["w"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]["x"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]["y"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]["z"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]["A"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]["B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]["C"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]["D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]["E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]["F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]["H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]["I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]["K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]["L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]["M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]["O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]["P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]

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orm"]=Module["asm\"][["Q"]].apply(null,arguments);var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm\"][["R"]].apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm\"][["S"]].apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm\"][["T"]].apply(null,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm\"][["U"]].apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm\"][["V"]].apply(null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm\"][["W"]].apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm\"][["X"]].apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm\"][["Y"]].apply(null,arguments));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm\"][["Z"]].apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm\"][["_"]].apply(null,arguments));var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\"][["$"]].apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][["aa"]].apply(null,arguments));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm\"][["ba"]].apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm\"][["ca"]].apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm\"][["da"]].apply(null,arguments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm\"][["ea"]].apply(null,arguments));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm\"][["fa"]].apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm\"][["ga"]].apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm\"][["ha"]].apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm\"][["ia"]].apply(null,arguments));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm\"][["ja"]].apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm\"][["ka"]].apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm\"][["la"]].apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm\"][["ma"]].

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).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).apply(
null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(
null,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(
null,arguments));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(
null,arguments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"ra"]).apply(
null,arguments));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"sa"]).
apply(
null,arguments));var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"ta"]).apply(
null,arguments));var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"ua"]).apply(
null,arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=
Module["asm"][_"va"]).apply(
null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"wa"]).
apply(
null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"][_"xa"]).apply(
null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"ya"]).apply(
null,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"za"]).apply(
null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa
"]).apply(
null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba"]).
apply(
null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca"]).
apply(
null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(
null,arguments));var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).
apply(
null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(
null,arguments));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(
null,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][_"Ha"]).apply(
null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(
null,arguments));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][_"Ja"]).apply(
null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(
null,arguments));var

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s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][_"Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][_"Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name=_"ExitStatus";this.message=_"Program terminated with
exit("+status+"");this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"](_"Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](_"");},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=Module["preInit"];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n\n);nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\nimport './flags_wasm';\n\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\n\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\n\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.worker.js';\n\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\n\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n
return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *
util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values
as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n
memoryOffset);\n }\n }\n\n read(dataId: DataId): Promise<backend_util.BackendValues> {\n return
this.readSync(dataId);\n }\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,
dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n
}\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n
}\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n
this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n
const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():
32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n
this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:

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number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n TypedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n
case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new
Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,
size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\nfunction
createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n
imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n
 WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n
 });\n });\n });\n return {};\n });\n\n /**\n * Returns the path of the WASM binary.\n * @param
simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n *
@param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n
 simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n
 // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return
wasmPath;\n }\n\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&
threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =
'tfjs-backend-wasm-simd.wasm';\n }\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n }\n }\n\n return wasmModuleFolder + path;\n }\n\n /**\n * Initializes the wasm
module and creates the js <--> wasm bridge.\n * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in
Chrome 76).\n */\n export async function init(): Promise<{wasm: BackendWasmModule}> {\n const
[simdSupported, threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n });\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the ' +\n 'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
reject({message: rejectMsg});\n });\n\n let wasm: Promise<BackendWasmModule>;\n // If `wasmPath` has

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been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported && wasmPath ==
null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob(\n [var WasmBackendModuleThreadedSimd = `
+\n wasmFactoryThreadedSimd.toString()),\n {type: 'text/javascript'});\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n }; \n\n resolve({ wasm: module });\n
});\n});\n\nfunction typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n
throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = ['tfjs-backend-
wasm.wasm', 'tfjs-backend-wasm-simd.wasm', 'tfjs-backend-wasm-threaded-simd.wasm'] as const;\n\nlet WasmBinaryName =
typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:
string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet
customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*/\n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n
 '\n `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n * @param `js` setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
```\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n *   Note that this prefix will be used to load each binary (vanilla,\n *
SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n *
full paths specifying the locations of those binaries. This is useful if\n *   your WASM binaries are not all located
in the same directory, or if your\n *   WASM binaries have been renamed.\n * @param usePlatformFetch optional
boolean to use platform fetch to download\n *   the wasm file, default to false.\n * @doc {heading:
'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPaths(\n  prefixOrFileMap: string|{[key in
WasmBinaryName]?: string},\n  usePlatformFetch = false): void {\n  if (initAborted) {\n    throw new Error(\n
'The WASM backend was already initialized. Make sure you call ' +\n      '\n      `setWasmPaths()` before you call
`tf.setBackend()` or ' +\n      '\n      `tf.ready()`);\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix
= prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths =\n      wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n    if (missingPaths.length > 0) {\n      throw new
Error(\n        `There were no entries found for the following binaries: ` +\n        ` ${missingPaths.join(',')}. Please
either call setWasmPaths with a ` +\n        ` map providing a path for each binary, or with a string indicating ` +\n
        ` the directory where all the binaries can be found.`);\n    }\n  }\n  customFetch = usePlatformFetch;\n}\n\n/**
Used in unit tests. */\n\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n
}

```


C,IAAI,MAAM,GAAG,CAAC,CAAC;IACf,IAAI,IAAI,IAAI,IAAI,EAAE;QACb,IAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,IAAI,CAAC,MAAM,CAAC,CAAC;QACpD,IAAI,QAAQ,CAAC,KAAK,CAAC,MAAM,KAAK,CAAC,EAAE;YAC/B,MAAM,IAAI,KAAK,CACX,iDAAiD;iBACjD,UAAQ,QAAQ,CAAC,KAAK,CAAC,MAAM,MAAG,CAAA,CAAC,CAAC;SACvC;QACD,MAAM,GAAG,QAAQ,CAAC,EAAE,CAAC;KACtB;IACD,IAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;QAC3D,CAAC;QACD,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,sBAAsB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC5D,IAAM,eAAe,GACjB,iBAAiB,CAAC,UAAkD,CAAC,CAAC;IAC1E,IAAI,eAAe,IAAI,IAAI,EAAE;QAC3B,MAAM,IAAI,KAAK,CACR,UAAU,mDAAgD;YAC7D,sBAAsB,CAAC,CAAC;KAC7B;IAED,IAAM,OAAO,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IACrD,IAAM,QAAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IACtD,IAAM,QAAQ,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IAE5B,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,QAAQ,EAAE,OAAO,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACvE,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEnD,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;IACnE,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;IAEnE,eAAe,CACX,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,UAAU,EAAE,UAAU,EAAE,eAAe,EAAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;IAEhC,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,iBAAiB,GAAiB;IAC7C,UAAU,EAAEA,qBAAY;IACxB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACbB,UAAU,EAAE,gBAAoC;CACjD;;AC7GD;;;;;;;SABgB,uBAAuB,CACnC,UAAkB,EAAE,OAAkB;IACxC,IAAI,QAA6D,CAAC;IAEIE,SAAS,SAAS,CAAC,OAAoB;QACrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAAC;KACJ;IAED,SAAS,UAAU,CAAC,IAAiD;QAE5D,IAAA,sBAAO,EAAW,iBAAC,CAAU;QACpC,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC;QAC5D,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;;QAGnD,IAAIC,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;YACvC,OAAO,GAAG,CAAC;SACZ;QAED,QAAQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;QACxC,OAAO,GAAG,CAAC;KACZ;IAED,OAAO,EAAC,UAAU,YAAA,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,WAAA,EAAE,UAAU,YAAA,EAAC,CAAC;AACIE;;ACpDA;;;;;;;AAoBO,IAAM,SAAS,GAAiB,uBAAuB,CAACC,YAAG,CAAC;;ACpBnE;;;;;;;SABgB,wBAAwB,CACpC,UAAkB,EAAE,qBAA8B,EACID,KAAgB;IACIB,IAAI,QAGQ,CAAC;IAEb,SAAS,SAAS,CAAC,OAAoB;QACrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;YACR,OA AO;YACP,QAAQ;YACR,QAAQ;YACR,OAAO;YACP,QAAQ;YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAAC;KACJ;IAED,SAAS,UAAU,CAAC,IAAkD;QAE7D,IAAA,sBAAO,EAAE,oBAAM,CAAS;QACxB,IAAA,YAAC,EAAE,YAAC,CAAW;QACtB,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,IAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAE/C,IAAM,UAAU,GAAG,KAAK,IAAI,IAAI,GAAG,KAAK,GAAG,CAAC,CAAC,KAAK,CAAC;QACnD,IAAM,QAAQ,GAAGC,qBAAY,CAAC,0BAA0B,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;QAC3E,IAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,UAAU,CAAC,CAAC;;QAGrD,IAAIF,aAAI,CAAC,aAAa,CAAC,QAAQ,CAAC,KAAK,CAAC,EAAE;YACtC,OAAO,GAAG,CAAC;SACZ;QAED,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;QACnE,IAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM,CAAC,CAAC;QACnE,IAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACnD,IAAM,UAAU,GAAG,cAAM,OAAA,QAAQ,CAC7B,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,QAAQ,CAAC,CA

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 */

```
=====  
*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-core';  
\nimport {BackendWasm} from './backend_wasm';  
\nimport {concat} from './Concat';  
\nimport {expandDims} from './ExpandDims';  
\n\nexport function pack(\n  args: {inputs: PackInputs, backend: BackendWasm, attrs: PackAttrs}):  
  TensorInfo {\n    const {inputs, backend, attrs} = args;  
    const {axis} = attrs;  
  
    if (inputs.length === 1) {\n      return expandDims(\n        {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n    }\n  
    const shape = inputs[0].shape;  
    const dtype = inputs[0].dtype;  
  
    inputs.forEach(t => {\n      util.assertShapesMatch(\n        shape, t.shape, \n        'All tensors passed to stack must have matching shapes');  
      util.assert(\n        dtype === t.dtype, \n        () => 'All tensors passed to stack must have matching dtypes');\n    });  
  
    const intermediateTensorInfos: TensorInfo[] = [];  
    const expandedTensors = inputs.map(t => {\n      const expandedT =\n        expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});  
      intermediateTensorInfos.push(expandedT);  
      return expandedT;\n    });  
  
    const result = concat({inputs: expandedTensors, backend, attrs: {axis}});  
  
    intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));  
  
    return result;\n  }\n\nexport const packConfig: KernelConfig = {\n  kernelName: Pack,\n  backendName: 'wasm',\n  kernelFunc: pack as {} as KernelFunc\n};
```

Found in path(s):

*/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.js.map

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

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 */
```

```
=====  
*\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';  
\nimport {createUnaryKernelConfig} from './unary_kernel';  
\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Log.js.map

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=====
*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js.map

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=====
*\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
```



```
=====\n
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/Multiply.js.map
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```

```
=====\n
*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmClip: (xId: number, min:
 number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
 backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
 max\n 'number' // out_id\n ]);\n\nfunction clip(args: {\n inputs: ClipByValueInputs,\n backend:
 BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n
const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
 backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId,
 clipValueMin, clipValueMax, outId);\n return out;\n}\n\nexport const clipByValueConfig: KernelConfig = {\n
kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip as {} as
KernelFunc\n};\n\n"]}
```

Found in path(s):

```
* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
wasm/dist/kernels/ClipByValue.js.map
```

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 * =====
 */
```

```
/**
 * @deprecated Use `setWasmPaths` instead.
 * Sets the path to the `.wasm` file which will be fetched when the wasm
 * backend is initialized. See
 * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
 * for more details.
 * @param path wasm file path or url
 * @param usePlatformFetch optional boolean to use platform fetch to download
 * the wasm file, default to false.
 *
 * @doc {heading: 'Environment', namespace: 'wasm'}
 */
```

Found in path(s):

`/opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js`

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=====

Found in path(s):

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+BAA+B,CAAC,CAAC;KACID;IACD,OOAO,kBAakB,CAAC;AAC5B,CAAC", "sourcesContent":["/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====\n *\nimport './flags_wasm';\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule,
WasmFactoryConfig } from './wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from
 './wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:

```

number[], dtype: DataType):\n    DataId {\n    const dataId = {id: this.dataIdNextNumber++};\n    this.move(dataId, values, shape, dtype, 1);\n    return dataId;\n  }\n  numDataIds(): number {\n    return this.dataIdMap.numDataIds();\n  }\n  async time(f: () => void): Promise<BackendTimingInfo> {\n    const start = util.now();\n    f();\n    const kernelMs = util.now() - start;\n    return {kernelMs};\n  }\n  move(\n    dataId: DataId, values: backend_util.BackendValues, shape: number[],\n    dtype: DataType, refCount: number): void {\n    const id = this.dataIdNextNumber++;\n    if (dtype === 'string') {\n      const stringBytes = values as Uint8Array[];\n      this.dataIdMap.set(\n        dataId,\n        {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n    }\n    return;\n  }\n  const size = util.sizeFromShape(shape);\n  const numBytes = size * util.bytesPerElement(dtype);\n  const memoryOffset = this.wasm._malloc(numBytes);\n  this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n  this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n  if (values != null) {\n    this.wasm.HEAPU8.set(\n      new Uint8Array(\n        (values as backend_util.TypedArray).buffer,\n        (values as backend_util.TypedArray).byteOffset, numBytes),\n      memoryOffset);\n  }\n  }\n  async read(dataId: DataId): Promise<backend_util.BackendValues> {\n    return this.readSync(dataId);\n  }\n  readSync(dataId: DataId): backend_util.BackendValues {\n    const {memoryOffset, dtype, shape, stringBytes} =\n      this.dataIdMap.get(dataId);\n    if (dtype === 'string') {\n      return stringBytes;\n    }\n    const bytes = this.wasm.HEAPU8.slice(\n      memoryOffset,\n      memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n    return typedArrayFromBuffer(bytes.buffer, dtype);\n  }\n  /**\n   * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n   * is released, false otherwise.\n   * @param dataId\n   * @oaram force Optional, remove the data regardless of refCount\n   */\n  disposeData(dataId: DataId, force = false): boolean {\n    if (this.dataIdMap.has(dataId)) {\n      const data = this.dataIdMap.get(dataId);\n      data.refCount--;\n      if (!force && data.refCount > 0) {\n        return false;\n      }\n      this.wasm._free(data.memoryOffset);\n      this.wasm.tfjs.disposeData(data.id);\n      this.dataIdMap.delete(dataId);\n    }\n    return true;\n  }\n  /** Return refCount of a `TensorData`. */\n  refCount(dataId: DataId): number {\n    if (this.dataIdMap.has(dataId)) {\n      const tensorData = this.dataIdMap.get(dataId);\n      return tensorData.refCount;\n    }\n    return 0;\n  }\n  incRef(dataId: DataId) {\n    const data = this.dataIdMap.get(dataId);\n    if (data != null) {\n      data.refCount++;\n    }\n  }\n  floatPrecision(): 32 {\n    return 32;\n  }\n  // Returns the memory offset of a tensor. Useful for debugging and unit\n  // testing.\n  getMemoryOffset(dataId: DataId): number {\n    return this.dataIdMap.get(dataId).memoryOffset;\n  }\n  dispose() {\n    this.wasm.tfjs.dispose();\n    if ('PThread' in this.wasm) {\n      this.wasm.PThread.terminateAllThreads();\n    }\n    this.wasm = null;\n  }\n  memory() {\n    return {unreliable: false};\n  }\n  /**\n   * Make a tensor info for the output of an op. If `memoryOffset` is not\n   * present, this method allocates memory on the WASM heap. If `memoryOffset`\n   * is present, the memory was allocated elsewhere (in c++) and we just record\n   * the pointer where that memory lives.\n   */\n  makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n    TensorInfo {\n    let dataId: {};\n    if (memoryOffset == null) {\n      dataId = this.write(null /* values */, shape, dtype);\n    } else {\n      const id = this.dataIdNextNumber++;\n      dataId = {id};\n      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n      const size = util.sizeFromShape(shape);\n      this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n    }\n    return {dataId, shape, dtype};\n  }\n  typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n    backend_util.TypedArray {\n    const buffer = this.wasm.HEAPU8.buffer;\n    const {memoryOffset} = this.dataIdMap.get(dataId);\n    const size = util.sizeFromShape(shape);\n    switch (dtype) {\n    case 'float32':\n      return new Float32Array(buffer, memoryOffset, size);\n    case 'int32':\n      return new Int32Array(buffer, memoryOffset, size);\n    case 'bool':\n      return new Uint8Array(buffer, memoryOffset, size);\n    default:\n      throw new Error(`Unknown dtype ${dtype}`);\n    }\n  }\n  function createInstantiateWasmFunc(path: string) {\n    // this will be replace by rollup plugin patchWechatWebAssembly in\n    // miniprogram's output.\n    // tslint:disable-next-line:no-any\n    return (imports: any, callback: any) => {\n      util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n        if (!response['ok']) {\n          imports.env.a^ failed to load wasm binary file at '${path}';\n        }\n        response.arrayBuffer().then(binary => {\n          WebAssembly.instantiate(binary, imports).then(output => {\n            callback(output.instance, output.module);\n          });\n        });\n      });\n    };

```



```

'int32':\n    return new Int32Array(buffer);\n  case 'bool':\n    return new Uint8Array(buffer);\n  default:\n    throw new Error(`Unknown dtype ${dtype}`);\n  }\n}\n\nconst wasmBinaryNames = [\n  'tfjs-backend-wasm.wasm',\n  'tfjs-backend-wasm-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\ntype WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n */\n * @doc {heading: 'Environment', namespace: 'wasm'}\n * ^\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n    'setWasmPath has been deprecated in favor of setWasmPaths and ' +\n    ' will be removed in a future release.);\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call ' +\n      '`setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n  }\n  wasmPath = path;\n  customFetch = usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n * `js` setWasmPaths({\n *   'tfjs-backend-wasm.wasm': 'renamed.wasm',\n *   'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *   'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n */\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n */\n * @doc {heading: 'Environment', namespace: 'wasm'}\n * ^\nexport function setWasmPaths(\n  prefixOrFileMap: string|{[key in WasmBinaryName]?: string},\n  usePlatformFetch = false): void {\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call ' +\n      '`setWasmPaths()` before you call `tf.setBackend()` or ' +\n      '`tf.ready()`);\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix = prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths =\n      wasmBinaryNames.filter(name => wasmFileMap[name] === null);\n    if (missingPaths.length > 0) {\n      throw new Error(\n        `There were no entries found for the following binaries: ` +\n        `${missingPaths.join(',')}. Please either call setWasmPaths with a ` +\n        `map providing a path for each binary, or with a string indicating ` +\n        `the directory where all the binaries can be found.`);\n    }\n  }\n  customFetch = usePlatformFetch;\n}\n\n/**\n * Used in unit tests.\n */\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n  wasmFileMap = {};\n  customFetch = false;\n  initAborted = false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n * This must be called before calling\n * `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads: number) {\n  threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * It is set after the backend is initialized.\n */\nexport function getThreadsCount(): number {\n  if (actualThreadsCount === -1) {\n    throw new Error(`WASM backend not initialized.`);\n  }\n  return actualThreadsCount;\n}\n}

```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.js.map

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

```

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```
=====\n*\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.js.map

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

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```

```
=====\n*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.js.map

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

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```

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Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====

```
\n *\n *\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from  
 './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>  
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu,  
  null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // leakyrelu_alpha\n    'number', //  
  out_id\n  ]);\n\n  export function leakyRelu(\n    args: \n      {inputs: LeakyReluInputs, attrs: LeakyReluAttrs,  
      backend: BackendWasm}): \n      TensorInfo {\n    const {inputs: {x}, attrs: {alpha}, backend} = args;\n\n    const xId =  
      backend.dataIdMap.get(x.dataId).id;\n    // According to TF API, LeakyRelu returns float32 when input is either  
      float32\n    // or int32.\n    const out = backend.makeOutput(x.shape, 'float32');\n\n    if (util.sizeFromShape(x.shape)  
      !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmFunc(xId, CppDType[x.dtype], alpha,  
      outId);\n    }\n\n    return out;\n  }\n\n  export const leakyReluConfig: KernelConfig = {\n    kernelName: LeakyRelu,\n    backendName: 'wasm',\n    setupFunc,\n    kernelFunc: leakyRelu as {} as KernelFunc,\n  };
}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-
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No license file was found, but licenses were detected in source scan.

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```

void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
  null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n}\n\nfunction batchMatMul(args: {\n  inputs: BatchMatMulInputs,\n  backend: BackendWasm,\n  attrs: BatchMatMulAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {a, b} = inputs;\n  const {transposeA, transposeB} = attrs;\n  if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n    throw new Error(\n      `BatchMatMul for non non-float32 tensors not yet supported.`);\n  }\n  const aRank = a.shape.length;\n  const bRank = b.shape.length;\n  const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n  const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n  const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n  const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n  const outerDimsA = a.shape.slice(0, -2);\n  const outerDimsB = b.shape.slice(0, -2);\n  const batchDimA = util.sizeFromShape(outerDimsA);\n  const batchDimB = util.sizeFromShape(outerDimsB);\n  const batchDimsCompatible =\n    batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n  util.assert(\n    aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n    () => `Error in matMul: the input batch dimensions must either be the` +\n      ` same or at least one input batch dimension must be 1. Got input` +\n      ` batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n  const outShapeOuterDims =\n    batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n  const outShape =\n    outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n  util.assert(\n    innerShapeA === innerShapeB,\n    () => `Error in matMul: inner shapes (${innerShapeA}) and` +\n      ` (${innerShapeB}) of Tensors with shapes` +\n      ` ${a.shape} and` +\n      ` ${b.shape} and transposeA=${transposeA}` +\n      ` and transposeB=${transposeB}` +\n      ` must match.`);\n  const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n    [batchDimA, outerShapeA, innerShapeA];\n  const b3dShape = transposeB ? [batchDimB, outerShapeB,\n    innerShapeB] :\n    [batchDimB, innerShapeB, outerShapeB];\n  // The rest of the implementation is designed to operate on rank-3 tensors\n  const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n  const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n  const a3dId = backend.dataIdMap.get(a3d.dataId).id;\n  const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n  const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];\n  const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n  const batchDim = Math.max(batchDimA, batchDimB);\n  const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);\n  const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);\n  wasmBatchMatMul(\n    a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes,\n    b3d.shape.length, transposeA, transposeB, outId);\n  backend.disposeData(a3d.dataId);\n  backend.disposeData(b3d.dataId);\n  out.shape = outShape;\n  return out;\n}\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName: BatchMatMul,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: batchMatMul as {} as KernelFunc\n};\n"}

```

Found in path(s):

```

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.js.map

```

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

```

{"version":3,"file":"tf-backend-wasm.fesm.js","sources":["../src/kernels/types.ts","../src/kernels/_FusedMatMul.ts","../src/kernels/unary_kernel.ts","../src/kernels/Abs.ts","../src/kernels/binary_kernel.ts","../src/kernels/Add.ts","../src/kernels/AddN.ts","../src/kernels/Identity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js","../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-

```

```

cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/k
ernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Co
nv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kerne
ls/Cumsum.ts","../src/kernels/DepthToSpace.ts","../src/kernels/DepthwiseConv2dNative.ts","../src/kernels/Elu.ts","..
../src/kernels/Equal.ts","../src/kernels/Exp.ts","../src/kernels/ExpandDims.ts","../src/kernels/Fill.ts","../src/kernels/Flip
LeftRight.ts","../src/kernels/Floor.ts","../src/kernels/FloorDiv.ts","../src/kernels/FusedBatchNorm.ts","../src/kernels/
FusedConv2D.ts","../src/kernels/FusedDepthwiseConv2D.ts","../src/kernels/GatherNd.ts","../src/kernels/GatherV2.ts"
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c/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/M
aximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts",".
../src/kernels/MirrorPad.ts","../src/kernels/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_uti
l.ts","../src/kernels/NonMaxSuppressionV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSu
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src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Sof
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src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../sr
c/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-backend-wasm-threaded-
simd.worker.js","../wasm-out/tfjs-backend-
wasm.js","../src/backend_wasm.ts","../src/version.ts","../src/base.ts"],"sourcesContent":["/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, activation: number,\n  biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n

```



```
*/\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*/\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-\ncore';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nexport\nfunction createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:\n DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*\n void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n ]);\n}\nfunction kernelFunc(args: { backend: BackendWasm, inputs: BinaryInputs }):\n TensorInfo {\n const { backend,\n inputs } = args;\n const { a, b } = inputs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId =\n backend.dataIdMap.get(b.dataId).id;\n const outputType = dtype != null ? dtype : a.dtype;\n const newShape =\n backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n const out = backend.makeOutput(newShape,\n outputType);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return\n out;\n }\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes =\n new Uint8Array(new Int32Array(b.shape).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n // Currently only some float operations support full broadcast.\n if\n (supportsFullBroadcast && a.dtype === 'float32') {\n kernelFunc();\n return out;\n }\n const\n aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n const bBroadcastDims =\n backend_util.getBroadcastDims(b.shape, newShape);\n const loopsOverAllOfA = aBroadcastDims.every((v, i) =>\n v === i);\n const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA &&\n loopsOverAllOfB) {\n kernelFunc();\n return out;\n } else {\n throw new Error(\n `Broadcasting\n along outer dims is not yet ` +\n `supported for ${a.dtype} ${kernelName}.`);\n }\n }\n return\n {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */
```

```
=====\n*/\nimport { Add, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
```


governing permissions and\n * limitations under the License.\n *

```
=====\n*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmFunc:\n (inputIds:\n Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\nfunction setupFunc(backend:\n BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n ]);\n}\nfunction addn(args: {inputs:\n TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} = args;\n const out =\n backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x =>\n backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,\n CppDType[out.dtype], outId);\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n kernelName:\n AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n{TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nexport function\nidentity(args: {inputs: IdentityInputs, backend: BackendWasm}):\n TensorInfo {\n const {inputs: {x}, backend} =\n args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.toArrayFromHeap(x);\n const outVals = backend.toArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const\nidentityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n kernelFunc: identity as {} as\n KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed\n * on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {identity} from\n './Identity';\nimport {CppType} from './types';\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array,\n xShapeLength: number, dtype: CppDType,\n outId: number, perm: Uint8Array, permLength: number) =>\n void;\nfunction setup(backend: BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /*\n void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n ]);\n}\n\nexport function transpose(\n args:\n {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}): \n TensorInfo {\n const {inputs,\n backend, attrs} = args;\n // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n // better\n // due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,\n attrs.perm);\n\n let permIsNoOp = true;\n for (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp = false;\n }\n }\n\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId: inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n\n if (permIsNoOp) {\n const
```



```

AllAttrs});\n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x}
= inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const
{transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if
(inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    input =
transposed;\n    inputId = transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n
const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n
const {transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis,
backend);\n\n  if (inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n
input = transposed;\n    inputId = transposedId;\n  }\n\n  const inputRank = input.shape.length;\n
backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n  const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n  kernelName: Any,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: any as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-

```

```

core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from
 './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:
 number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n  'number', // outer_size\n  'number', // inner_size\n  'number' // out_id\n  ]);\n\n  function argmax(\n    args:
    {inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\n    const {backend, inputs, attrs} = args;\n
    const {axis} = attrs as {} as ArgMaxAttrs;\n    const {x} = inputs as {} as ArgMaxInputs;\n    const xId =
    backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes,
    inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n
      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose
was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId =
transposedId;\n      }\n    }\n\n    const outShape = input.shape.slice(0, -1);\n    const out =
    backend.makeOutput(outShape, 'int32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const outerSize =
    util.sizeFromShape(out.shape);\n    const innerSize = input.shape[axes[0]];\n    wasmFunc(inputId,
    CppDType[input.dtype], outerSize, innerSize, outId);\n\n    if (inputWasTransposed) {\n      // dispose of the
transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    return out;\n  }\n\n  export const
  argMaxConfig: KernelConfig = {\n    kernelName: ArgMax,\n    backendName: 'wasm',\n    kernelFunc: argmax as {}
as KernelFunc,\n    setupFunc: setup\n  };}\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
 '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmAvgPool: (\n  xId:
 number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:
 number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, strideHeight: number,\n
 strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n  'number', // xId\n  'number', // batchSize\n
  'number', // inputHeight\n  'number', // inputWidth\n  'number', // filterHeight\n  'number', // filterWidth\n
  'number', // padTop\n  'number', // padRight\n  'number', // padBottom\n  'number', // padLeft\n  'number', //
strideHeight\n  'number', // strideWidth\n  'number', // channels\n  'number', // outId\n  ]);\n\n  function
  avgPool(\n    args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n    const {inputs, attrs,
    backend} = args;\n\n    const x = inputs.x as Tensor4D;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    const
    {filterSize, strides, pad, dimRoundingMode} = attrs;\n    const convInfo = backend_util.computePool2DInfo(\n
    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n    const filterHeight =
    convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n
    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft =
    convInfo.padInfo.left;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n
    const channels = convInfo.inChannels;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n
      `wasm backend does not support dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n
    }\n\n    if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n      throw new Error(\n
      `was backend
only supports average pooling with dilation = [1, 1], ` +\n      `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n    }\n\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const
    outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmAvgPool(\n      xId, x.shape[0], x.shape[1], x.shape[2],
    filterHeight, filterWidth,\n      padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
  }

```

```

outId);\n return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: avgPool as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====
\n
*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function reshape(\n  args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n  const {inputs, attrs} = args;\n  const {x} = inputs;\n  const {shape} = attrs;\n\n  const xSize = util.sizeFromShape(x.shape);\n  const $shape = util.inferFromImplicitShape(shape, xSize);\n\n  util.assert(\n    xSize === util.sizeFromShape($shape),\n    () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old\n    `shape must have the same number of elements.`);\n\n  // Backend needs to track refCount for the dataId for reshape op\n  args.backend.incRef(x.dataId);\n\n  return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====
\n
*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {a, b} = inputs;\n    const {transposeA, transposeB} = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n        `BatchMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n\n    const batchDimA = util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n\n    const batchDimsCompatible =\n      batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input batch dimensions must either be the\n      `same or at least one input batch dimension must be 1. Got input\n      `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n    const outShapeOuterDims =\n      batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n    const outShape =\n      outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n    util.assert(\n      innerShapeA === innerShapeB,\n      () => `Error in matMul: inner shapes (${innerShapeA}) and (\n      `-${innerShapeB}) of Tensors with shapes

```


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```
=====\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function cast(\n  args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n  TensorInfo {\n    const {inputs: {x}, attrs: {dtype}, backend} = args;\n    const out = backend.makeOutput(x.shape, dtype);\n    const inVals = backend.toArrayFromHeap(x);\n    const outVals = backend.toArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n  }\nexport const castConfig: KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n  kernelFunc: cast as {} as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from '../unary_kernel';\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', // max\n    'number' // out_id\n  ]);\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend: BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {clipValueMin, clipValueMax} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmClip(xId, clipValueMin, clipValueMax, outId);\n    return out;\n  }\n  export const clipByValueConfig: KernelConfig = {\n    kernelName: ClipByValue,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: clip as {} as KernelFunc\n  };}\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from
```



```

dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number',
// outputChannels\n 'number', // outId\n ]);\n}\n\nfunction conv2d(\n  args: {inputs: Conv2DInputs, backend:
BackendWasm, attrs: Conv2DAttrs}) {\n  const {inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n
const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n    pad, dimRoundingMode, false,
$dataFormat);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const
padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom =
convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
convInfo.inChannels;\n  const outputChannels = convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend
Conv2D does not support dataFormat:` +\n      ` ${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n  }\n\n
const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  wasmConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n    filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:
number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', //
outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number',
// fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', //
xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number',
// yChannelStride\n 'number', // outId\n ]);\n}\n\nfunction conv2DBackpropInput(args: {\n  backend:
BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n  const dilations = 1;\n\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n

```



```

number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n
'number', // boxesId\n 'number', // boxIndId\n 'number', // numBoxes\n 'array', // images shape\n 'number',
// cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number'
// out id\n ]);\n}\n\nfunction cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n
attrs: CropAndResizeAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {method,
extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} = inputs;\n const numBoxes =
boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape =
[numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData =
backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const
out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n wasmCropAndResize(\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\n
InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n extrapolationValue, outId);\n\n if
(castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
\n\n
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from
'./types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n finalDim: number, outId: number, dtype: CCppType) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n
'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //
dtype\n ]);\n}\n\nexport function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,
exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype === 'float32' || x.dtype ===
'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n // permute required axis
to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n
if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n
const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n
const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CCppType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n {inputs: {x: permutedOut}, attrs:

```

```

{perm: undoPermutation}, backend});\n  backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n } \n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n  kernelName: Cumsum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: cumsum as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n    'number', // xId\n    'number', // blockSize\n    'number', // channelsLast\n    'array', // xStrides\n
'number', // xStridesLength\n    'array', // outputShape\n    'array', // outputStrides\n    'number', // outSize\n
'number', // outId\n  ]);\n}\n\nexport function depthToSpace(args: {\n  backend: BackendWasm,\n  inputs:
DepthToSpaceInputs,\n  attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n  const {blockSize, dataFormat} = attrs;\n\n  const batchSize = x.shape[0];\n  const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n  const
outputHeight = inputHeight * blockSize;\n  const outputWidth = inputWidth * blockSize;\n  const outputDepth =
inputDepth / (blockSize * blockSize);\n\n  const outputShape = (dataFormat === 'NHWC') ?\n    [batchSize,
outputHeight, outputWidth, outputDepth] :\n    [batchSize, outputDepth, outputHeight, outputWidth];\n\n  const
out = backend.makeOutput(outputShape, 'float32');\n\n  const xData = backend.dataIdMap.get(x.dataId);\n  const
xId = xData.id;\n  const xStridesBytes =\n    new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n\n  const outputShapeBytes = new Uint8Array(new
Int32Array(outputShape).buffer);\n  const outStridesBytes =\n    new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n  wasmDepthToSpace(\n    xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n  return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n  kernelName: DepthToSpace,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n  xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight:
number, dilationWidth: number, strideHeight: number,\n  strideWidth: number, inputChannels: number,

```


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```
=====  
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version  
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 law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
 the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====  
*\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from  
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from  
 './Reshape';\nexport function expandDims(args: {\n  inputs: ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: BackendWasm\n}) {\n  const {inputs, attrs, backend} = args;\n  const {input} = inputs;\n  const {dim} =  
 attrs;\n\n  const inputRank = input.shape.length;\n  const newShape = input.shape.slice();\n  let $dim = dim;\n  if  
 (dim < 0) {\n    // Negative value is counted from the tail of rank.\n    util.assert(\n      -(inputRank + 1) <= dim,\n      () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n        inputRank\n      }];\n      $dim = inputRank + dim  
 + 1;\n    }\n    newShape.splice($dim, 0, 1);\n  }\n  return reshape({inputs: {x: input}, backend, attrs: {shape:  
 newShape}});\n}\nexport const expandDimsConfig: KernelConfig = {\n  kernelName: ExpandDims,\n  backendName: 'wasm',\n  kernelFunc: expandDims as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright  
 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,  
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
 governing permissions and\n * limitations under the License.\n *
```

```
=====  
*\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from  
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function fill(args: {attrs:  
 FillAttrs, backend: BackendWasm}) {\n  const {attrs: {shape, value, dtype}, backend} = args;\n  const out =  
 backend.makeOutput(shape, dtype);\n  const outVals = backendtypedArrayFromHeap(out);\n  outVals.fill(value as  
 number);\n  return out;\n}\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName:  
 'wasm',\n  kernelFunc: fill as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All  
 Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this  
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 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
 governing permissions and\n * limitations under the License.\n *
```

```
=====  
*\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-  
 core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmFlipLeftRight: (\n  xId: number, batch:  
 number, imageHeight: number, imageWidth: number,\n  numChannels: number, outId: number) =>  
 void;\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,  

```

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null /* void */, [n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // outId\n ]);\n}\n\nexport function flipLeftRight(\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n
const {image} = inputs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =
backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n wasmFlipLeftRight(\n imageId, batch,
imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n *
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number', 'number', 'number'];\n)\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =

```

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backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n    xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
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```

```

=====\n
*\n\nimport { backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ FusibleActivation } from './types';\n\nlet wasmFusedConv2d: (\n    xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n    filterId: number, filterHeight: number, filterWidth: number,\n    biasId: number,
padTop: number, padRight: number, padBottom: number,\n    padLeft: number, isSamePad: number,
dilationHeight: number,\n    dilationWidth: number, strideHeight: number, strideWidth: number,\n    inputChannels: number, outputChannels: number, activation: number,\n    preluActivationWeightsId: number,
leakyreluAlpha: number, outId: number) => \n    void;\n\nfunction setup(backend: BackendWasm) {\n
waswFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n    'number', // xId\n    'number', //
batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //
filterHeight\n    'number', // filterWidth\n    'number', // biasId\n    'number', // padTop\n    'number', //
padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', //
dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //
inputChannels\n    'number', // outputChannels\n    'number', // activation\n    'number', //
preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', // outId\n ]);\n\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n})
{\n const { inputs, attrs, backend } = args;\n const { x, filter, bias, preluActivationWeights } = inputs;\n const {\n
strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } =
attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as
Tensor4D).shape, strides, dilations,\n    pad, dimRoundingMode);\n\n const fusedActivation = \n
FusibleActivation[activation as { } as keyof typeof FusibleActivation];\n\n if (fusedActivation == null) {\n
throw new Error(\n    `${activation} activation not yet supported for FusedConv2D` +\n    `in the wasm backend.`);\n
}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if
(bias != null) {\n    const biasData = backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n
throw new Error(\n        `FusedConv2D only supports rank-1 bias but got ` +\n        `rank
${biasData.shape.length}`);\n    }\n    if (biasData.shape[0] !== outputChannels) {\n    throw new Error(\n
`FusedConv2D bias shape (${biasData.shape}) does not ` +\n        `match the number of output channels
(${outputChannels})`);\n    }\n    biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n    throw new Error(\n        `wasm backend FusedConv2D does not support
dataFormat:` +\n        `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =

```

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backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n
backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n  xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n  biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n  dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n  fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { FusibleActivation } from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n
filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number, padTop: number, padRight:
number, padBottom: number,\n  padLeft: number, isSamePad: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:
number, activation: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedDepthwiseConv2d =\n
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n    'number', // xId\n    'number', //
batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //
filterHeight\n    'number', // filterWidth\n    'number', // biasId\n    'number', // padTop\n    'number', //
padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', //
dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n
'number', // inputChannels\n    'number', // outputChannels\n    'number', // activation\n    'number', //
preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', // outId\n  ]);\n\nfunction
fusedDepthwiseConv2d(args: {\n  inputs: FusedDepthwiseConv2DInputs,\n  backend: BackendWasm,\n  attrs:
FusedDepthwiseConv2DAttrs\n}) {\n  const { inputs, attrs, backend } = args;\n  const { x, filter, bias,
preluActivationWeights } = inputs;\n  const {\n    strides,\n    pad,\n    dilations,\n    dataFormat,\n
dimRoundingMode,\n    activation,\n    leakyreluAlpha\n  } = attrs;\n\n  const convInfo =
backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n  const fusedActivation =\n    FusibleActivation[activation as {}
as keyof typeof FusibleActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n      `${activation}
activation not yet supported for FusedDepthwiseConv2D ` +\n      `in the wasm backend.`);\n  }\n\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const
outputChannels = convInfo.outChannels;\n\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =
backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got ` +\n      `rank ${biasData.shape.length}.`);\n    }\n
if (biasData.shape[0] !== outputChannels) {\n      throw new Error(\n      `FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not ` +\n      `match the number of output channels (${outputChannels})`);\n    }\n
biasId = biasData.id;\n  }\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =
convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const
padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =

```

```

convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize,
inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n
'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', //
sliceSize\n 'array', // strides\n 'number' // outId\n ]);\n}\n\nfunction gatherNd(args: {backend: BackendWasm,
inputs: GatherNdInputs}):\n TensorInfo {\n const {backend, inputs} = args;\n const {params, indices} =
inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n gather_util.prepareAndValidate(params,
indices);\n\n const out = backend.makeOutput(resultShape, params.dtype);\n if (numSlices === 0) {\n return
out;\n }\n\n const indicesShape = indices.shape;\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmGatherNd(\n xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n stridesBytes,
outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n"/**\n * @license\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====\n
*/\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppDType} from './types';\n\nlet
wasmGather:

```



```

(\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize:
number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n  'number', // xId\n  'number', // dtype\n  'array',
// xStrides\n  'number', // stridesSize\n  'number', // indicesId\n  'number', // batchSize\n  'array', //
outStrides\n  'number' // outId\n  ]);\n}\n\nfunction gatherV2(\n  args: {backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs}): \n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x,
indices} = inputs;\n  const {axis, batchDims} = attrs;\n\n  // Throw error when any index is out of bound.\n  const
parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n  const indicesVals = backend.readSync(indices.dataId) as
TypedArray;\n  const axisDim = x.shape[parsedAxis];\n  for (let i = 0; i < indicesVals.length; ++i) {\n  const index
= indicesVals[i];\n  util.assert(\n    index <= axisDim - 1 && index >= 0,\n    () =>\n      `GatherV2: the
index value ${index} is not in [0, ${axisDim - 1}]`);\n  }\n\n  const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n    x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n  const flattenX = reshape({\n    inputs: {x},\n    attrs: {\n      shape: [\n        shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n        shapeInfo.sliceSize\n      ]\n    },\n    backend\n  });\n  const
indicesSize = util.sizeFromShape(indices.shape);\n  const flattenIndex = reshape({\n    inputs: {x: indices},\n    attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n    backend\n  });\n  const flattenOutputShape =
[\n    shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n    shapeInfo.sliceSize\n  ];\n\n  const out = backend.makeOutput(flattenOutputShape, x.dtype);\n  if (util.sizeFromShape(x.shape) === 0) {\n
return out;\n  }\n  const stridesSize = flattenX.shape.length - 1;\n\n  const xData =
backend.dataIdMap.get(flattenX.dataId);\n  const xId = xData.id;\n\n  const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n  const indicesId = indicesData.id;\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const xStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n  const outStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n  wasmGather(\n    xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n    shapeInfo.batchSize, outStridesBytes, outId);\n\n  backend.disposeData(flattenX.dataId);\n  backend.disposeData(flattenIndex.dataId);\n\n  // reshape\n  out.shape =
shapeInfo.outputShape;\n  return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n  kernelName:
GatherV2,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n", "/**\n * @license\n * Copyright 2019

```

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // leakyrelu_alpha\n    'number', // out_id\n  ]);\n  export function leakyRelu(\n    args: \n      { inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm }):\n    TensorInfo {\n    const { inputs: { x }, attrs: { alpha }, backend } = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    // According to TF API, LeakyRelu returns float32 when input is either float32\n    // or int32.\n    const out = backend.makeOutput(x.shape, 'float32');\n    if (util.sizeFromShape(x.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n    }\n    return out;\n  }\n  export const leakyReluConfig: KernelConfig = {\n    kernelName: LeakyRelu,\n    backendName: 'wasm',\n    setupFunc,\n    kernelFunc: leakyRelu as {} as KernelFunc,\n  };,\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n}
```

```
=====\n*\n\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n  createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');,\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n
```

```
=====\n*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\n  createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');,\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n
```

```
=====\n*\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);,\n  /**\n   * @license\n   */\n
```

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```
=====\n\n*/\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from  
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
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```

```
=====\n\n*/\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from  
 '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport  
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:  
number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend:  
BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args: {backend:  
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {reductionIndices, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =  
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes,  
inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId =  
transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max',  
axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =  
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n    if  
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the  
transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const  
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\n  export const maxConfig: KernelConfig = {\n    kernelName: Max,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: max as {} as KernelFunc\n  };\n}"/**\n * @license\n * Copyright 2019 Google  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from  
 './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google
```

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmMaxPool: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n}\n\nfunction maxPool(\n  args: { inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs }) {\n  const { inputs, attrs, backend } = args;\n\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n\n  // TF API supports int32 input. CPU and WebGL backend also support int32\n  // input. WASM backend doesn't support it because it uses xnnpack which only\n  // supports float32.\n  // Add the following assert only for the WASM backend instead of at core op\n  // level.\n  // TODO: add support for int32 input.\n  util.assert(\n    x.dtype === 'float32',\n    () =>\n      `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n\n  const { filterSize, strides, pad, dimRoundingMode } = attrs;\n  const convInfo = backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels = convInfo.outChannels;\n\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);\n  }\n\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  wasmMaxPool(\n    xId, x.shape[0], x.shape[1], x.shape[2],\n    filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n    strideHeight, strideWidth, inputChannels, outputChannels, outId);\n  return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n  kernelName: MaxPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: maxPool\n} as KernelFunc;\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nimport
```



```

}\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const minConfig: KernelConfig = {\n
kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2021 Google
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-
paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n ]);\n}\n\nfunction
mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const
{inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n const outShape = paddings.map(\n (p, i) => p[0] /*
beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n
const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const
postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc:
setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====

```



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// Since we are not using scores for V3, we have to delete it from the heap.\n
backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor
=\n  backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as
KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =
backend.wasm.cwrap(\n    NonMaxSuppressionV4,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', //
scoreThreshold\n      'bool', // padToMaxOutputSize\n    ]);\n\n  function nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n  inputs: NonMaxSuppressionV4Inputs,\n  attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n    const { backend, inputs, attrs } = args;\n    const { iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize } =\n      attrs;\n    const { boxes, scores } = inputs;\n\n    const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n    const
resOffset = wasmFunc(\n      boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n      padToMaxOutputSize);\n\n    const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n      parseResultStruct(backend, resOffset);\n\n    // Since we are not using scores for V4, we have to delete it from the
heap.\n    backend.wasm._free(pSelectedScores);\n\n    const selectedIndicesTensor =\n      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n    const validOutputsTensor =
backend.makeOutput([], 'int32', pValidOutputs);\n\n    return [selectedIndicesTensor,\n      validOutputsTensor];\n  }\n\n  export const nonMaxSuppressionV4Config: KernelConfig = {\n    kernelName:
NonMaxSuppressionV4,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: nonMaxSuppressionV4 as { }
as KernelFunc,\n  }; \n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

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=====\n
*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n  softNmsSigma: number) =>\n  number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =
backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', //
softNmsSigma\n    ]);\n\n  export const nonMaxSuppressionV5Config: KernelConfig = {\n    kernelName:
NonMaxSuppressionV5,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: nonMaxSuppressionV5 as { }
as KernelFunc,\n  }; \n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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scoreThreshold\n    'number', // softNmsSigma\n    ]);\n\nfunction kernelFunc(args: {\n  backend:
BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[]
{\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma}
= attrs;\n  const {boxes, scores} = inputs;\n\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const
scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n  const resOffset = wasmFunc(\n    boxesId, scoresId,
maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n\n  const {pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n\n  // Since we are not using
validOutputs for V5, we have to delete it from the\n  // heap.\n  backend.wasm._free(pValidOutputs);\n\n  const
selectedIndicesTensor =\n    backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n  const
selectedScoresTensor =\n    backend.makeOutput([selectedSize, 'float32', pSelectedScores);\n\n  return
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
{\n  kernelName: NonMaxSuppressionV5,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc
as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*/\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*/\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n  indicesId: number, depth:
number, onValue: number, offValue: number,\n  outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n    'number', // indices_id\n
'number', // depth,\n    'number', // onValue\n    'number', // offValue\n    'number' // out_id\n  ]);\n}\n\nfunction
oneHot(\n  args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n  const {inputs,
backend, attrs} = args;\n  const {indices} = inputs;\n  const {depth, onValue, offValue} = attrs;\n\n  const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const indicesData = backend.dataIdMap.get(indices.dataId);\n  const indicesId = indicesData.id;\n\n
wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n  return out;\n}\n\nexport const oneHotConfig:
KernelConfig = {\n  kernelName: OneHot,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: oneHot as
{} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n  const {inputs: {x}, backend} = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(1);\n  return out;\n}\n\nexport const
onesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName: 'wasm',\n  kernelFunc: onesLike as
{} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

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*\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {concat} from './Concat';\n\nimport
{expandDims} from './ExpandDims';\n\nexport function pack(\n  args: {inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {axis} =
attrs;\n\n    if (inputs.length === 1) {\n      return expandDims(\n        {inputs: {input: inputs[0]}, backend,
attrs: {dim: axis}});\n    }\n\n    const shape = inputs[0].shape;\n    const dtype = inputs[0].dtype;\n\n    inputs.forEach(t => {\n
util.assertShapesMatch(\n      shape, t.shape,\n      'All tensors passed to stack must have matching shapes');\n
util.assert(\n      dtype === t.dtype,\n      () => 'All tensors passed to stack must have matching dtypes');\n    });\n\n    const intermediateTensorInfos: TensorInfo[] = [];\n    const expandedTensors = inputs.map(t => {\n      const
expandedT =\n        expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n      intermediateTensorInfos.push(expandedT);\n      return expandedT;\n    });\n\n    const result = concat({inputs:
expandedTensors, backend, attrs: {axis}});\n\n    intermediateTensorInfos.forEach(t =>
backend.disposeData(t.dataId));\n\n    return result;\n  }\n\nexport const packConfig: KernelConfig = {\n  kernelName:
Pack,\n  backendName: 'wasm',\n  kernelFunc: pack as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n
'array', // pre-paddings\n    'array', // post-paddings\n    'number', // constantValue\n    'number', // outId\n
]);\n\nfunction pad(\n  args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n  const
{inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n  const outShape = paddings.map(\n    (p, i) =>
p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n  if (util.sizeFromShape(x.shape) === 0) {\n    // Short-
circuit the computation, since x doesn't have value, only\n    // the shape is used to compute output shape to pad.\n
return fill({\n    backend,\n    attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n  });\n  }\n\n  const
xId = backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const

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outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n  new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n  new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n  xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], prePaddingsBytes,\n  postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} } as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, Pow } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n  createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n  'number', // x_id\n  'number', // weights_id\n  'number' //
out_id\n  ]);\n\n  function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n    const { inputs, backend
}
= args;\n    const { x, alpha } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n    let inputId = xId;\n    const input = x;\n    let castedInput = input;\n    if
(input.dtype !== 'float32') {\n      castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' });\n      inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n    }\n\n    const out = backend.makeOutput(x.shape, 'float32');\n
const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmPrelu(inputId, weightsId, outId);\n\n    if (input.dtype
!== 'float32') {\n      backend.disposeData(castedInput.dataId);\n    }\n    return out;\n  }\n\n  export const preluConfig:
KernelConfig = {\n    kernelName: Prelu,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: prelu as {} } as
KernelFunc\n  };\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmProd: (\n

```


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```
=====\n\n*\nimport {KernelConfig, Relu} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {cast} from\n './Cast';\nlet wasmResizeBilinear: (\n  xId: number, batch: number, oldHeight: number, oldWidth: number,\n  numChannels: number, newHeight: number, newWidth: number,\n  alignCorners: number, halfPixelCenters:\n  number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n  wasmResizeBilinear =\n  backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n    'number', // xId\n    'number', // batch\n    'number', //\n    oldHeight\n    'number', // oldWidth\n    'number', // numChannels\n    'number', // newHeight\n    'number', //\n    newWidth\n    'number', // alignCorners\n    'number', // halfPixelCenters\n    'number' // outId\n  ]);\n}\nfunction\n resizeBilinear(args: {\n  backend: BackendWasm,\n  inputs: ResizeBilinearInputs,\n  attrs: ResizeBilinearAttrs\n}):  
TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {images} = inputs;\n  const {alignCorners,\n  halfPixelCenters, size} = attrs;\n  const [newHeight, newWidth] = size;\n  const [batch, oldHeight, oldWidth,\n  numChannels] = images.shape;\n  const outShape = [batch, newHeight, newWidth, numChannels];\n  let xData =\n  backend.dataIdMap.get(images.dataId);\n  let castedData;\n  if (xData.dtype !== 'float32') {\n    castedData =\n    cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n    xData =\n    backend.dataIdMap.get(castedData.dataId);\n  }\n  const xId = xData.id;\n  const out =\n  backend.makeOutput(outShape, 'float32');\n  if (util.sizeFromShape(images.shape) === 0) {\n    return out;\n  }\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmResizeBilinear(\n    xId, batch, oldHeight,\n    oldWidth, numChannels, newHeight, newWidth,\n    alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n  if\n  (castedData !== null) {\n    backend.disposeData(castedData.dataId);\n  }\n  return out;\n}\n\nexport const\n resizeBilinearConfig: KernelConfig = {\n  kernelName: ResizeBilinear,\n  backendName: 'wasm',\n  setupFunc:\n  setup,\n  kernelFunc: resizeBilinear as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {identity} from
'./Identity';\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes: Uint8Array,
axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n    'number', // x_id\n
'array', // axes\n    'number', // axes_length\n    'array', // out_shape\n    'number', // out_shape_length\n    'number'
// out_id\n  ]);\n}\n\nexport function reverse(\n  args: {inputs: ReverseInputs, backend: BackendWasm, attrs:
ReverseAttrs});\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {dims} =
attrs;\n\n    const axes = util.parseAxisParam(dims, x.shape);\n\n    if (x.shape.length === 0) {\n      return
identity({inputs: {x}, backend});\n    }\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const axesBytes =
new Uint8Array(new Int32Array(axes).buffer);\n    const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n    wasmReverse(\n      xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n    const reshaped =\n      reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n    backend.disposeData(out.dataId);\n    return reshaped;\n  }\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as {} as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n    'number', // xId\n    'number', //
batch\n    'number', // imageHeight\n    'number', // imageWidth\n    'number', // numChannels\n    'number', //
radians\n    'number', // centerX\n    'number', // centerY\n    'array', // fillBytes\n    'number', // fillLength\n
'number', // outId\n  ]);\n}\n\nexport function rotateWithOffset(args: {\n  inputs: RotateWithOffsetInputs,\n
backend: BackendWasm,\n  attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} =
args;\n  const {image} = inputs;\n  const {radians, fillValue, center} = attrs;\n\n  const out =
backend.makeOutput(image.shape, image.dtype);\n  const imageId = backend.dataIdMap.get(image.dataId).id;\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n  const [centerX, centerY] =\n    backend_util.getImageCenter(center, imageHeight,
imageWidth);\n\n  const fillIsBlack = fillValue === 0;\n  const fullOpacityValue = 255;\n\n  const fillValues =
typeof fillValue === 'number' ?\n    [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n
[...fillValue, fullOpacityValue];\n  const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n\n
wasmRotate(\n    imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX,\n    centerY,
fillBytes, fillValues.length, outId);\n  return out;\n}\n\nexport const rotateWithOffsetConfig: KernelConfig = {\n
kernelName: RotateWithOffset,\n  backendName: 'wasm',\n  kernelFunc: rotateWithOffset as {} as KernelFunc,\n
setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *

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=====  
* \nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n", "/*\n *  
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 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a  
 copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable  
 law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
 the specific language governing permissions and\n * limitations under the License.\n *  
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* \nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n", "/*\n *  
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 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a  
 copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable  
 law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
 the specific language governing permissions and\n * limitations under the License.\n *  
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* \nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}  
 from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from  
 './types';\n\nlet wasmScatterNd: (\n  indicesId: number, updatesId: number, dtype: CppDType, sliceRank:  
 number,\n  numUpdates: number, sliceSize: number, strides: Uint8Array,\n  outputSize: number, outId: number)  
 => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmScatterNd = backend.wasm.cwrap(ScatterNd,  
 null /*void*/, [\n    'number', // indicesId\n    'number', // updatesId\n    'number', // dtype\n    'number', //  
 sliceRank\n    'number', // numUpdates\n    'number', // sliceSize\n    'array', // strides\n    'number', // outputSize\n    'number' // outId\n  ]);\n\n  function scatterNd(\n    args: {\n      backend: BackendWasm, inputs:  
 ScatterNdInputs, attrs: ScatterNdAttrs\n    }):\n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {indices,  
 updates} = inputs;\n    const {shape} = attrs;\n\n    const out = backend.makeOutput(shape, updates.dtype);\n    if  
 (util.sizeFromShape(shape) === 0) {\n      return out;\n    }\n\n    const {sliceRank, numUpdates, sliceSize, strides,  
 outputSize} =\n      scatter_util.calculateShapes(updates, indices, shape);\n\n    const indicesData =  
 backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const updatesData =  
 backend.dataIdMap.get(updates.dataId);\n    const updatesId = updatesData.id;\n\n    const stridesBytes = new  
 Uint8Array(new Int32Array(strides).buffer);\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmScatterNd(\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n      sliceSize,  
 stridesBytes, outputSize, outId);\n\n    return out;\n  }\n\n  export const scatterNdConfig: KernelConfig = {\n    kernelName: ScatterNd,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: scatterNd as {} as  
 KernelFunc\n  };  
", "/*\n *  
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 Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the  
 License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed  
 on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
 implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
 License.\n *  
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*\n\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId: number,
offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\n  'number', // conditionId\n  'number', // tId\n  'number', // eId\n
'number', // offset\n  'number', // outId\n  ]);\n\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\n  const {inputs, backend} = args;\n  const {condition, t, e} = inputs;\n\n  const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n  const tId = backend.dataIdMap.get(t.dataId).id;\n  const eId =
backend.dataIdMap.get(e.dataId).id;\n  const out = backend.makeOutput(t.shape, t.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const cRank = condition.shape.length;\n  const tRank =
t.shape.length;\n\n  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n  1 : \n
util.sizeFromShape(t.shape.slice(1));\n\n  wasmSelect(conditionId, tId, eId, offset, outId);\n  return out;\n}\n\nexport
const selectConfig: KernelConfig = {\n  kernelName: Select,\n  backendName: 'wasm',\n  kernelFunc: select as { }
as KernelFunc,\n  setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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*\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}): \n
TensorInfo {\n  const {backend, inputs: {x}} = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out
= backend.makeOutput(x.shape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  // Short-
circuit zero-sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n\n  wasmFunc(xId,
outId);\n  return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n  kernelName: 'Sigmoid',\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/*\n * @license\n
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:

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number, channels: number, batch: number) =>\n  void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n  'number', // xId\n  'number', // outId\n  'number', // channels\n  'number' // batch\n  ]);\n}\n\nfunction softmax(\n  args: {backend: BackendWasm,\n  inputs: SoftmaxInputs, attrs: SoftmaxAttrs});\n  TensorInfo {\n  const {backend, inputs: {logits}, attrs: {dim}} =\n  args;\n  const xId = backend.dataIdMap.get(logits.dataId).id;\n  const out = backend.makeOutput(logits.shape,\n  logits.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const channels = logits.shape[dim];\n  const batch = util.sizeFromShape(logits.shape) / channels;\n\n  // Short-circuit zero-sized tensors.\n  if\n  (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n\n  wasmFunc(xId, outId, channels, batch);\n  return\n  out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: softmax as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google\n  LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n  use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *  

=====*\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n  SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from\n  '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {padV2Config} from\n  './PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction\n  spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:\n  SpaceToBatchNDAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {blockShape,\n  paddings} = attrs;\n\n  const prod = util.sizeFromShape(blockShape);\n\n  const completePaddings: Array<[number,\n  number]> = [[0, 0];\n  completePaddings.push(...(paddings as Array<[number, number]>));\n\n  for (let i = 1 +\n  blockShape.length; i < x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n\n  const paddedX =\n  padV2Config.kernelFunc({\n  inputs: {x},\n  backend,\n  attrs: {paddings: completePaddings, constantValue:\n  0}\n  }) as TensorInfo;\n\n  const reshapedPaddedShape =\n  backend_util.getReshaped(paddedX.shape,\n  blockShape, prod, false);\n\n  const permutedReshapedPaddedPermutation =\n  backend_util.getPermuted(\n  reshapedPaddedShape.length, blockShape.length, false);\n\n  const flattenShape =\n  backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n  const reshapeInputs:\n  ReshapeInputs = {x: paddedX};\n  const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n  const\n  paddedXReshaped =\n  reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n  const transposeInputs:\n  TransposeInputs = {x: paddedXReshaped};\n  const transposeAttrs:\n  TransposeAttrs = {perm:\n  permutedReshapedPaddedPermutation};\n  const paddedXT =\n  transpose({inputs: transposeInputs, backend,\n  attrs: transposeAttrs});\n\n  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n  const\n  resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n  const result = reshape(\n  {inputs:\n  resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n  backend.disposeData(paddedX.dataId);\n  backend.disposeData(paddedXReshaped.dataId);\n  backend.disposeData(paddedXT.dataId);\n\n  return\n  result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n  backendName: 'wasm',\n  kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n  \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n  License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n  agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n  the specific language governing permissions and\n * limitations under the License.\n *  

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*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const {inputs, attrs, backend} = args;\n  const {x} = inputs;\n  const
{numOrSizeSplits, axis} = attrs;\n  const $axis = util.parseAxisParam(axis, x.shape)[0];\n  const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n  const begin = new Array(x.shape.length).fill(0);\n
const size = x.shape.slice();\n  return splitSizes.map(s => {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] =
s;\n    const xSlice =\n      slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n    begin[$axis] += s;\n
return xSlice;\n  });\n}\n\nexport const splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName:
'wasm',\n  kernelFunc: splitV as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n
* http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

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=====\n
*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:

```

```
BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n  'number', // x_id\n  'number', // alpha\n  'number', // dtype\n  'number', // out_id\n  ]);\n}\n\nfunction step(\n  args: {backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {alpha} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmStep(xId, alpha, CppDType[x.dtype], outId);\n    return out;\n  }\n}\n\nexport const stepConfig: KernelConfig = {\n  kernelName: Step,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: step as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*/\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array, xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', // xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number', // outShapeLength\n    'number', // outId\n  ]);\n}\n\nexport function stridedSlice(args: {\n  backend: BackendWasm,\n  inputs: StridedSliceInputs,\n  attrs: StridedSliceAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x} = inputs;\n  const {\n    begin,\n    end,\n    strides,\n    beginMask,\n    endMask,\n    ellipsisMask,\n    newAxisMask,\n    shrinkAxisMask\n  } = attrs;\n  const {\n    finalShapeSparse,\n    finalShape,\n    isIdentity,\n    sliceDim0,\n    isSimpleSlice,\n    begin: $begin,\n    end: $end,\n    strides: $strides\n  } =\n    slice_util.sliceInfo(\n      x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n      newAxisMask, shrinkAxisMask);\n  let result;\n  if (isIdentity) {\n    // Optimization #1, slice is a no-op plus reshape\n    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n  } else if (sliceDim0 || isSimpleSlice) {\n    // Optimization #2, slice is memory contiguous (only occurs in dim 0)\n    util.assert(\n      x.shape.length >= 1,\n      () => `Input must have rank at least 1, got: ${x.shape.length}`);\n    const size = slice_util.computeOutShape($begin, $end, $strides);\n    // To tolerate begin[0] > end[0] (a 0-output slice), we min(begin, end).\n    const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});\n    result =\n      reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n    backend.disposeData(sliced.dataId);\n  } else {\n    const out =\n      backend.makeOutput(finalShapeSparse, 'float32');\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xStridesBytes =\n      new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n    const beginBytes =\n      new Uint8Array(new Int32Array($begin).buffer);\n    const endBytes =\n      new Uint8Array(new Int32Array($end).buffer);\n    const stridesBytes =\n      new Uint8Array(new Int32Array($strides).buffer);\n    const outputShapeBytes =\n      new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n    const outStridesBytes =\n      new Uint8Array(\n        new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n    const outId =\n      backend.dataIdMap.get(out.dataId).id;\n\n    wasmStridedSlice(\n      xId, xStridesBytes, x.shape.length, beginBytes, endBytes, stridesBytes,\n      outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n    result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n    backend.disposeData(out.dataId);\n  }\n}\n\nreturn result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n  kernelName: StridedSlice,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
```

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```
=====  
* \nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core'; \nimport {createBinaryKernelConfig} from  
'./binary_kernel'; \nconst supportsFullBroadcast = true; \nexport const subConfig: KernelConfig = \ncreateBinaryKernelConfig(Sub, supportsFullBroadcast); \n", "/* \n * @license \n * Copyright 2019 Google LLC. All  
Rights Reserved. \n * Licensed under the Apache License, Version 2.0 (the "License"); \n * you may not use this  
file except in compliance with the License. \n * You may obtain a copy of the License at  
http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable law or agreed to in writing,  
software \n * distributed under the License is distributed on an "AS IS" BASIS, \n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific language  
governing permissions and \n * limitations under the License. \n *
```

```
=====  
* \n \nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from  
'@tensorflow/tfjs-core'; \nimport {BackendWasm} from './backend_wasm'; \nimport  
{permuteAxesAndTranspose} from './kernel_utils'; \nimport {CppType} from './types'; \n \nlet wasmSum: (xId:  
number, reduceSize: number, dtype: number, outId: number) => \n void; \n \nfunction setup(backend:  
BackendWasm): void { \n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [ \n 'number', // input_id \n  
'number', // reduce_size \n 'number', // dtype \n 'number', // out_id \n ]); \n \nfunction sum(args: {backend:  
BackendWasm, inputs: SumInputs, attrs: SumAttrs}): \n TensorInfo { \n const {backend, inputs, attrs} = args; \n  
const {axis, keepDims} = attrs; \n const {x} = inputs; \n const xId = backend.dataIdMap.get(x.dataId).id; \n let  
inputId = xId; \n let input = x; \n \n const {transposed, axes, originalAxes, inputWasTransposed} = \n  
permuteAxesAndTranspose(x, axis, backend); \n \n let reductionAxes = axes; \n if (inputWasTransposed) { \n const  
transposedId = backend.dataIdMap.get(transposed.dataId).id; \n if (transposedId !== xId) { \n // transpose was  
not a no-op. We will need to dispose of this \n // once we are done. \n input = transposed; \n inputId =  
transposedId; \n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,  
input.shape.length); \n } \n } \n backend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes,  
input.shape.length); \n const [outShape, reduceShape] = \n  
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes); \n const reduceSize =  
util.sizeFromShape(reduceShape); \n \n const out = backend.makeOutput(outShape, input.dtype); \n if  
(util.sizeFromShape(input.shape) !== 0) { \n const outId = backend.dataIdMap.get(out.dataId).id; \n  
wasmSum(inputId, reduceSize, CCppType[out.dtype], outId); \n } \n \n if (inputWasTransposed) { \n // dispose of  
the transposed tensor. \n backend.disposeData(transposed.dataId); \n } \n \n if (keepDims) { \n // reshape \n const  
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes); \n out.shape = newShape; \n } \n \n  
return out; \n } \n \nexport const sumConfig: KernelConfig = { \n kernelName: Sum, \n backendName: 'wasm', \n  
setupFunc: setup, \n kernelFunc: sum as { } as KernelFunc \n }; \n", "/* \n * @license \n * Copyright 2021 Google  
LLC. All Rights Reserved. \n * Licensed under the Apache License, Version 2.0 (the "License"); \n * you may not  
use this file except in compliance with the License. \n * You may obtain a copy of the License at  
http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable law or agreed to in writing,  
software \n * distributed under the License is distributed on an "AS IS" BASIS, \n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific language  
governing permissions and \n * limitations under the License. \n *
```

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=====  
* \nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core'; \nimport {createUnaryKernelConfig} from  
'./unary_kernel'; \nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan); \n", "/* \n * @license \n *  
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```

\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (\n  xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', // x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n  ]);\n}\nfunction tile(\n  args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const {reps} = attrs;\n  const newShape: number[] = new Array(x.shape.length);\n  for (let i = 0; i < newShape.length; i++) {\n    newShape[i] = x.shape[i] * reps[i];\n  }\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n  const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n  const out = backend.makeOutput(newShape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmTile(\n    xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n    CppDType[out.dtype], outId);\n  return out;\n}\nexport const tileConfig: KernelConfig = {\n  kernelName: Tile,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: tile as {} as KernelFunc\n};\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmTopK: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n  xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,\n  outIndicesId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n    'number', // xId\n    'array', // x_shape\n    'number', // x_shape.length\n    'number', // x_dtype\n    'number', // k\n    'bool', // sorted\n    'number', // outValuesId\n    'number', // outIndicesId\n  ]);\n}\nexport const topk: (\n  args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) => \n  TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n  const {x} = inputs;\n  const {k, sorted} = attrs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n  const outputShape = x.shape.slice();\n  outputShape[outputShape.length - 1] = k;\n  const outValues = backend.makeOutput(outputShape, x.dtype);\n
```

```

const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
backend.makeOutput(outputShape, 'int32');\n
backend.dataIdMap.get(outIndices.dataId).id;\n\n
wasmTopK(\n      xId, xShapeBytes, x.shape.length,\n      CppDType[x.dtype], k, sorted,\n      outValuesId, outIndicesId);\n\n
return [outValues, outIndices];\n
};\n\n
export const topKConfig: KernelConfig = {\n  kernelName: TopK,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: topk as { } as KernelFunc,\n};\n\n
"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n
*/\n\n
import {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\n
import {BackendWasm} from '../backend_wasm';\n\n
let wasmTransform: (\n  imageId: number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth: number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number) => void;\n\n
function setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform, null /*void*/, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n    'number', // batch\n    'number', // outHeight\n    'number', // outWidth\n    'number', // numChannels\n    'number', // imageWidth\n    'number', // imageHeight\n    'array', // strides\n    'number', // stridesLength\n    'number', // interpolationModeId\n    'number', // fillModeId\n    'number', // fillValue\n    'number' // outId\n  ]);\n\n
function transform(\n  args: \n    {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {image, transforms} = inputs;\n    const {interpolation, fillMode, fillValue, outputShape} = attrs;\n    const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n    const [outHeight, outWidth] =\n      outputShape != null ? outputShape : [imageHeight, imageWidth];\n    const outShape =\n      [batch, outHeight, outWidth,\n        numChannels] as [number, number, number, number];\n    const strides =\n      new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n\n    const out = backend.makeOutput(outShape, image.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const imageData = backend.dataIdMap.get(image.dataId);\n    const imageId = imageData.id;\n\n    const transformsData = backend.dataIdMap.get(transforms.dataId);\n    const transformsId = transformsData.id;\n\n    const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n    let fillModeId;\n    switch (fillMode) {\n      case 'constant':\n        fillModeId = 1;\n        break;\n      case 'reflect':\n        fillModeId = 2;\n        break;\n      case 'wrap':\n        fillModeId = 3;\n        break;\n      case 'nearest':\n        fillModeId = 4;\n        break;\n      default:\n        fillModeId = 1;\n        break;\n    }\n\n    wasmTransform(\n      imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n      outWidth, numChannels, imageWidth, imageHeight, strides,\n      image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n      outId);\n\n    return out;\n  }\n\n  export const transformConfig: KernelConfig = {\n    kernelName: Transform,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: transform as { } as KernelFunc\n };\n\n  "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n

```

```

*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n  args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n  TensorInfo[] {\n  const { inputs, backend, attrs } = args;\n  const { value } = inputs;\n  let { axis } = attrs;\n  if (axis <
0) {\n  axis += value.shape.length;\n  }\n\n  const numOutputs = value.shape[axis];\n  const rank =
value.shape.length;\n  const outShape: number[] = new Array(rank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < rank;\n  i++) {\n  if (i !== axis) {\n  outShape[outIndex++] = value.shape[i];\n  }\n  }\n  const outs: TensorInfo[] = new
Array(numOutputs);\n  const begin = new Array(rank).fill(0);\n  const size = value.shape.slice();\n  size[axis] = 1;\n  for (let i = 0; i < outs.length; i++) {\n  begin[axis] = i;\n  outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },
backend});\n  }\n  return outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n  }\n\nexport const
unpackConfig: KernelConfig = {\n  kernelName: Unpack,\n  backendName: 'wasm',\n  kernelFunc: unpack as { } as
KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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=====\n
*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {\n  const { inputs: { x }, backend } = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.typedArrayFromHeap(out);\n  outVals.fill(0);\n  return out;\n  }\n\nexport const
zerosLikeConfig: KernelConfig = {\n  kernelName: ZerosLike,\n  backendName: 'wasm',\n  kernelFunc: zerosLike
as { } as KernelFunc,\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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```

=====\n *\n//

```

```

We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
'./kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport
{ anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig }
from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport
{ batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport
{ ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport
{ concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport
{ conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from
'./kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from
'./kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig }
from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from
'./kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from
'./kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from

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./kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
./kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
./kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
{fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from
./kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n  \n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n
  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n
  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n
  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n
  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n
  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n  fusedBatchNormConfig,\n
  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n  gatherV2Config,\n  greaterConfig,\n
  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n  lessEqualConfig,\n  logConfig,\n
  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  meanConfig,\n  minConfig,\n
  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  nonMaxSuppressionV3Config,\n
  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  notEqualConfig,\n  oneHotConfig,\n
  onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  preluConfig,\n  prodConfig,\n  rangeConfig,\n

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realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n    2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n  ]));\n\n**\n * True if threads are supported.\n *\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n  return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n  return WebAssembly.validate(new Uint8Array([\n    0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n    4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n  ]));\n } catch (e) {\n  return false;\n };\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = __scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n  WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd: {};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program\";var quit_=function(status,toThrow){throw toThrow};var

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ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\\\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\\\"path\\\").
dirname(scriptDirectory)+\\\"^\"}else{scriptDirectory=__dirname+\\\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\\\"argv\\\"].length>1){thisProgram=process[\\\"argv\\\"][[1]].replace(/\\\\\\\\\\\\g,\\\"^\\\")}arguments_=process[\\\"arg
v\\\"].slice(2);process[\\\"on\\\"](\\\"uncaughtException\\\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\\\"on\\\"](\\\"unhandledRejection\\\",abort);quit_=function(status){process[\\\"exit\\\"](status)};Module[\\\"insp
ect\\\"]=function(){return\\\"[Emscripten Module object]\\\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\\\"worker_threads\\\")}catch(e){console.error(\\\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\\\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\\\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\\\"){return new
Uint8Array(readbuffer(f))}data=read(f,\\\"binary\\\");assert(typeof data===\"object\\\");return data};if(typeof
scriptArgs!=\"undefined\\\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\\\"){arguments_=arguments}if(typeof
quit===\"function\\\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\\\"){if(typeof
console===\"undefined\\\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\\\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\\\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\"undefined\\\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\\\"blob:\\\")!=\"0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\\\"^\\")+1)}else{scriptDirectory=\\\"}\\\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.responseType=\\\"arraybuffer\\\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,true);xhr.responseType=\\\"arraybuffer\\\";xhr.onload=function(){if(xhr.status

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==200||xhr.status===0&&xhr.response){onload(xhr.response);return }onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\undefined\){global.performance=require(\perf_hooks\).performance}}var
out=Module[\print\]|console.log.bind(console);var err=Module[\printErr\]|console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\arguments\])arguments_=Module[\arguments\];if(Module[\thisProgram\])thisProgram=
Module[\thisProgram\];if(Module[\quit\])quit_=Module[\quit\];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\wasmBinary\])wasmBinary=Module[\wasmBinary\];var
noExitRuntime=Module[\noExitRuntime\]|true;if(typeof WebAssembly!=="object"){abort(\no native wasm
support detected)}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\Assertion failed: \"+text)}}function getCFunc(ident){var
func=Module[\_\"+ident];assert(func,\\"Cannot call unknown function \"+ident+\", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC=\\\"string\\\":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\\\"array\\\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\\\"string\\\")return UTF8ToString(ret);if(returnType===\\\"boolean\\\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\\\"number\\\"});var
numericRet=returnType!==\\\"string\\\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\\\"\\\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\\\"\\\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var

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len=0;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((ru
nDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new

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Error).stack);what+="\":err(what);ABORT=true;EXITSTATUS=1;what="\abort(\"+what+\"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="\data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="\file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="\tfjs-backend-wasm-threaded-
simd.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\\"same-
origin\").then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)}})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\\"wasm-
instantiate\").}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\\"same-
origin\").then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\\"wasm streaming compile failed: \"+reason);err(\\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0});};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA

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TCH:110,ENOCESI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOANO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:128,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFUSED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOSTDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,EPROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,ENOTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:148,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)return-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,mainThreadWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw"Atomic.notify returned an unexpected value
"+ret}Module["_emsripten_futex_wake"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! killThread() can only ever be
called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
killThread!";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runningWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}function
cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cancelThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
cancelThread!";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({"cmd":"cancel"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! cleanupThread() can only
ever be called from main application thread!";if(!pthread_ptr)throw"Internal Error! Null pthread_ptr in
cleanupThread!";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);_emsripten_thread_init(tb,!ENVIRONMENT_IS_WORKER,1);_emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},threadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.length>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor

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e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\\":"exit"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\\":"cancelDone"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+'\", but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\\"){cleanupThread(d["thread"])}else
if(cmd===\"killThread\\"){killThread(d["thread"])}else
if(cmd===\"cancelThread\\"){cancelThread(d["thread"])}else
if(cmd===\"loaded\\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete worker.runPthread}}else if(cmd===\"print\\"){out(\"Thread \"+d["threadId"]+\"\":
'+d["text"])}else if(cmd===\"printErr\\"){err(\"Thread \"+d["threadId"]+\"\": '+d["text"])}else
if(cmd===\"alert\\"){alert(\"Thread \"+d["threadId"]+\"\": '+d["text"])}else if(cmd===\"exit\\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\"exitProcess\\"){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\\"){worker.postMessage(e.data)}else{err(\"worker sent an unknown command
'+cmd')}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent
an error! \"+e.filename+\":'+e.lineno+\":
'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata})});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post

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Message({\cmd\":"load\","urlOrBlob\":"Module[\mainScriptUrlOrBlob\]"|_scriptDir,\wasmMemory\":"wasmMemory,\wasmModule\":"wasmModule})),allocateUnusedWorker:function(){var pthreadMainJs=locateFile(\tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnusedWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var t=performance.now()+msecs;while(performance.now()<t){}};function establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop)}Module[\establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return noExitRuntime}Module[\getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\"]=invokeEntryPoint;function __assert_fail(condition,filename,line,func){abort(\Assertion failed: \"+UTF8ToString(condition)+\", at: \"+[filename?UTF8ToString(filename):\unknown filename],line,func?UTF8ToString(func):\unknown function\")}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var _emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var t=process[\hrtime\"];return t[0]*1e3+t[1]/1e6}}else if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-Module[\__performance_now_clock_drift\"]}}else if(typeof dateNow!=="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(1,1,func,arg)}function __emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage({\cmd\":"processQueuedMainThreadWork\"})}else if(ENVIRONMENT_IS_PTHREAD){postMessage({\targetThread\":"targetThreadId,\cmd\":"processThreadQueue\"})}else{var pthread=PThread.threads[targetThreadId];var worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\cmd\":"processThreadQueue\"})}return 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function _emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function _emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-28;if(!ENVIRONMENT_IS_WEB){var ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-73;if(ret==="not-equal")return-6;if(ret==="ok")return 0;throw\Atomics.wait returned an unexpected value \"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var tNow=performance.now();var tEnd=tNow+timeout;var lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNow=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);return-73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return 0}}function _emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function _emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\os\").cpus().length;return navigator[\hardwareConcurrency\"]}function _emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var

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args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){ var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);return
ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){ var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){ var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){ var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef

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_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("\'ANGLE_instanced_arrays\");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ext["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcount){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};return 1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("\'OES_vertex_array_object\");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("\'WEBGL_draw_buffers\");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension("\'WEBGL_multi_dra
w\'))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\'webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="\'undefined\'|webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[contex
tHandle])GL.currentContext=null;if(typeof
JSEvents==="\'object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("\'

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EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+"\["+j+"]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return 0}var
contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iocnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iow,iocnt,pnum);var num=0;for(var i=0;i<iocnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var

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pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={`cmd\":"run\","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\undefined){err(\Current
environment does not support SharedArrayBuffer, pthreads are not available!")}return
6}if(!pthread_ptr){err(\pthread_create called with a null thread pointer!")}return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=-
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd="spawnThread";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\Canceled!}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread");}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\pthread_join attempted on a null thread
pointer!")}return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\PThread
\'+thread+\ is attempting to join to itself!")}return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err(\Main thread
\'+thread+\ is attempting to join to itself!")}return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\pthread_join attempted on thread
\'+thread+\ , which does not point to a valid thread, or does not exist anymore!")}return
ERRNO_CODES.ESRCH}var

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detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}function _pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_w
rite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory|Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"

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asm\"][\["G\").apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm\"][\["H\").apply(
null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm\"][\["J\").apply(null,arguments
)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm\"][\["K\").apply(null,argumen
ts)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm\"][\["L\").apply(null,arg
uments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm\"][\["M\").apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm\"][\["N\").apply(null,argumen
ts)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm\"][\["O\").ap
ply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm\"][\["P\").a
pply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm\"][\["Q\").apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm\"][\["R\").apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module[\
"asm\"][\["S\").apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm\"][\["T\").app
ly(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm\"][\["U\").apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm\"][\["V\").apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm\"][\["W\").apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize\"]=
Module["asm\"][\["X\").apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm\"][\["Y\").a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace\"]=M
odule["asm\"][\["Z\").apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=M
odule["_DepthwiseConv2dNative"]=Module["asm\"][\["_").apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm\"][\["$").apply(null,arguments)
};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm\"][\["aa\").apply(null,ar
guments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm\"][\["ba\").apply(null,argument
s)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight\"]=Modu
le["asm\"][\["ca\").apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm\"][\["da\").apply(null,arg

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uments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][\["ea\"]).
apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchN
orm"]=Module["asm"][\["fa\"]).apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Mod
ule["asm"][\["ga\"]).apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=M
odule["_FusedDepthwiseConv2D"]=Module["asm"][\["ha\"]).apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][\["ia\"]).apply(nul
l,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][\["ja\
"]).apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][\["ka\"]).apply(
null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[\
"asm"][\["la\"]).apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][\
"ma\"]).apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][\["na\"]).apply(null,argume
nts));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][\["o
a\"]).apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][\["pa\"]).apply(null,argument
s));var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"][\["qa\"]).apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][\["ra\"]).apply(null,argume
nts));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][\["sa\"]).
apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][\["t
a\"]).apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][\["ua\"]).apply(null,ar
guments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][\["va\"]).apply(null,argumen
ts));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][\["wa
\"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][\["x
a\"]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][\["ya\"]).a
pply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][\["za\"]).apply(null,argumen
ts));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][\["Aa\"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod

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ule["_NonMaxSuppressionV4"]=Module["_asm"]["_Ba"].apply(null,arguments);var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["_asm"]["_Ca"]).apply(null,arguments);var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["_asm"]["_Da\
"]).apply(null,arguments);var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["_asm"]["_Ea"]).apl
y(null,arguments);var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["_asm"]["_Fa"]).apply(nu
ll,arguments);var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["_asm"]["_Ga"]).apply(null,argume
nts);var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["_asm"]["_Ha"]).apply(nu
ll,arguments);var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["_asm"]["_Ia"]).apply(nu
ll,arguments);var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["_asm"]["_Ja"]).app
ly(null,arguments);var
_RelU=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["_asm"]["_Ka"]).apply(nu
ll,arguments);var
_RelU6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["_asm"]["_La"]).apply(nu
ll,arguments);var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear\
"]=Module["_asm"]["_Ma"]).apply(null,arguments);var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["_asm"]["_Na"]).app
ly(null,arguments);var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["_asm"]["_Oa"]).apply(null,arguments);var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["_asm"]["_Pa"]).apply(nu
ll,arguments);var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["_asm"]["_Qa"]).apply(nu
ll,arguments);var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["_asm"]["_Ra
"]).apply(null,arguments);var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["_asm"]["_Sa\
"]).apply(null,arguments);var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["_asm"]["_Ta"]).ap
ply(null,arguments);var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["_asm"]["_Ua"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["_asm"]["_Va"]).a
pply(null,arguments);var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["_asm"]["_Wa"]).apply(nu
ll,arguments);var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["_asm"]["_Xa"]).apply(n
ull,arguments);var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["_asm"]["_Ya"]).apply(null,arguments);var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["_asm"]["_Za"]).apply(nu
ll,arguments);var

```

```

nts));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]["_a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]["$a"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]["ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]["bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]["cb"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]["db"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]["eb"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]["fb"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]["gb"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]["hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]["ib"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]["jb"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]["kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["asm"]["lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"]["mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"]["nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["asm"]["ob"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["asm"]["pb"]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["asm"]["qb"]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["asm"]["rb"]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["asm"]["sb"]).apply(null,arguments)};var

```



```

WasmBackendModuleThreadedSimd;\n","export const wasmWorkerContents = 'var Module={ };function
threadPrintErr(){ var text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert(){ var text=Array.prototype.slice.call(arguments).join("
\");postMessage({ cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["_instantiateWasm"]=function(info,receiveInstance){ var
instance=new
WebAssembly.Instance(Module["_wasmModule"],info);Module["_wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){ }this.onmessage=function(e){ try {if(e.data.cmd===\load\"){Module["_wasmModule"]=e.data.wa
smModule;Module["_wasmMemory"]=e.data.wasmMemory;Module["_buffer"]=Module["_wasmMemory"].buffer;
Module["_ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===\string\){importScripts(e.data.urlOrBlob)}else{ var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){ Module=instance;moduleLoaded()})}else
if(e.data.cmd===\objectTransfer\"){Module["_PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\run\"){Module["_performance_now_clock_drift"]=performance.now()-
e.data.time;Module["_emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["_establishStackSpace"](top,max);Module["_emscripten_tls_init"](
);Module["_PThread"].receiveObjectTransfer(e.data);Module["_PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{ var
result=Module["_invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["_getNoExitRuntime"]())Module[_
"PThread"].threadExit(result)} catch(ex){ if(ex===\Canceled!\){Module["_PThread"].threadCancel()} else
if(ex!=\unwind\"){if(ex instanceof
Module["_ExitStatus"]){if(Module["_getNoExitRuntime"]()){ } else {Module["_PThread"].threadExit(ex.status)} } el
se {Module["_PThread"].threadExit(-2);throw ex } } } else
if(e.data.cmd===\cancel\"){if(Module["_pthread_self"]()){Module["_PThread"].threadCancel()} } else
if(e.data.target===\setimmediate\"){ } else
if(e.data.cmd===\processThreadQueue\"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()} } else {err(\worker.js received unknown command
\"+e.data.cmd);err(e.data)} } catch(ex){err(\worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex } };if(typeof process===\object"\&&typeof
process.versions===\object"\&&typeof process.versions.node===\string"){ self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\worker_threads\);global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\message",function(data){ onmessage({ data:data })});var
nodeFS=require(\fs\");var nodeRead=function(filename){ return nodeFS.readFileSync(filename,\utf8\");}function
globalEval(x){ global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f)});postMessage=function(msg){ parentPort.postMessage(msg)};if(typeof
performance===\undefined\){performance={now:function(){return Date.now()}}};";\nvar
WasmBackendModule = (function() {\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=\undefined"?WasmBackendModule: { };var
readyPromiseResolve,readyPromiseReject;Module["_ready"]=new
Promise(function(resolve,reject){ readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides= { };var key;for(key in
Module){ if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] } }var arguments_=[];var

```

```

thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\\\\");arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insep
t\"]=function(){return\"[Emscripten Module object]\"}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)};readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src;if(_scriptDir){s
criptDirectory=_scriptDir;if(scriptDirectory.indexOf(\"blob:\")!=\"=0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}}read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)};readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} else {var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){abort(\"no native wasm
support detected\")}var wasmMemory;var ABORT=false;var EXITSTATUS;function

```

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assert(condition,text){if(!condition){abort("\Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"\Cannot call unknown function "+ident+", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\string\)return UTF8ToString(ret);if(returnType===\boolean\)return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\number\});var
numericRet=returnType!==\string\;if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder(\utf8\):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++
]=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function

```

```

preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]}(runDependencies)}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]}(runDependencies)}if(runDepen
dencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()} }Module["preloadedImages"]={ };Module
["preloadedAudios"]={ };function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort(\"+what+\"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]()["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]()["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return

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instantiateArrayBuffer(receiveInstantiatedSource)}}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback=="function"){callback(Module);continue}var func=callback.func;if(typeof
func=="number"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}function _abort(){abort()}function
_emscipten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscipten_get_heap_size(){return HEAPU8.length}function
emscipten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscipten_resize_heap(requestedSize){var oldSize=_emscipten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iovcnt,pnum){var num=0;for(var
i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_thread_create(){return 6}function _thread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case
131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return
32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case
37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return
16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return
64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator==="object")return navigator["hardwareConcurrency"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={"a":_abort,"d":_emscipten_memcpy_big,"e":_emscipten_resize_heap,"f":_fd_close,"c":_f
d_seek,"b":_fd_write,"h":_pthread_create,"g":_pthread_join,"i":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module["___wasm_call_ctors"]=function(){return(___wasm_call_ctors=Module["___wasm
_call_ctors"]=Module["asm"])[k]}.apply(null,arguments);var
_init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"])[l]}.apply(null,arguments);
var

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_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Module["_init_with_threads_count"]=Module["asm"][["m"]]).apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads_count"]=Module["asm"][["n"]]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm"][["o"]]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"][["p"]]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"][["q"]]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"][["s"]]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"][["t"]]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"][["u"]]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"][["v"]]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"][["w"]]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"][["x"]]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"][["y"]]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"][["z"]]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"][["A"]]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"][["B"]]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"][["C"]]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][["D"]]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][["E"]]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][["F"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][["G"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][["H"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][["I"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][["J"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][["K"]]).apply(null,arguments)};var

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_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][["L"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][["M"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][["N"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][["O"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][["P"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][["Q"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][["R"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][["S"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][["T"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][["U"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][["V"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][["W"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][["X"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][["Y"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][["Z"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][["_"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][["$"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][["aa"]]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][["ba"]]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][["ca"]]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][["da"]]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][["ea"]]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][["fa"]]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][["ga"]]).apply(null,arguments)};var

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_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][["ha"]]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][["ia"]]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][["ja"]]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][["ka"]]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][["la"]]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][["ma"]]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][["na"]]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][["oa"]]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][["pa"]]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][["qa"]]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][["ra"]]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][["sa"]]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][["ta"]]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][["ua"]]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][["va"]]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][["wa"]]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][["xa"]]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][["ya"]]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][["za"]]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][["Aa"]]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][["Ba"]]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][["Ca"]]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][["Da"]]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][["Ea"]]).apply(null,arguments)};var

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_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][_"Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][_"Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();
readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun()}
if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"]("");},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof

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this.dataIdMap.delete(dataId);\n  }\n  return true;\n }\n\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n  if (this.dataIdMap.has(dataId)) {\n    const tensorData =\n      this.dataIdMap.get(dataId);\n    return tensorData.refCount;\n  }\n  return 0;\n }\n\n incRef(dataId: DataId) {\n  const data = this.dataIdMap.get(dataId);\n  if (data !== null) {\n    data.refCount++;\n  }\n }\n\n floatPrecision():\n 32 {\n  return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n  return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n  this.wasm.tfjs.dispose();\n  if ('PThread' in this.wasm) {\n    this.wasm.PThread.terminateAllThreads();\n  }\n  this.wasm = null;\n }\n\n memory() {\n  return {unreliable:\n    false};\n }\n\n /**\n  * Make a tensor info for the output of an op. If `memoryOffset` is not\n  * present, this method allocates memory on the WASM heap. If `memoryOffset`\n  * is present, the memory was allocated elsewhere (in c++) and we just record\n  * the pointer where that memory lives.\n  */\n makeOutput(shape:\n  number[], dtype: DataType, memoryOffset?: number):\n  TensorInfo {\n  let dataId: {};\n  if (memoryOffset\n    == null) {\n    dataId = this.write(null /* values */, shape, dtype);\n  } else {\n    const id =\n      this.dataIdNextNumber++;\n    dataId = {id};\n    this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n      refCount: 1});\n    const size = util.sizeFromShape(shape);\n    this.wasm.tfjs.registerTensor(id, size,\n      memoryOffset);\n  }\n  return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n  TensorInfo):\n  backend_util.TypedArray {\n  const buffer = this.wasm.HEAPU8.buffer;\n  const\n    {memoryOffset} = this.dataIdMap.get(dataId);\n  const size = util.sizeFromShape(shape);\n  switch (dtype) {\n  case 'float32':\n    return new Float32Array(buffer, memoryOffset, size);\n  case 'int32':\n    return new\n      Int32Array(buffer, memoryOffset, size);\n  case 'bool':\n    return new Uint8Array(buffer, memoryOffset,\n      size);\n  default:\n    throw new Error(`Unknown dtype ${dtype}`);\n  }\n }\n\n\nfunction\n  createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollup plugin patchWechatWebAssembly in\n  // miniprogram's output.\n  // tslint:disable-next-line:no-any\n  return (imports: any, callback: any) => {\n    util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n        imports.env.a(`failed to load wasm binary file at '${path}'`);\n      }\n      response.arrayBuffer().then(binary => {\n        WebAssembly.instantiate(binary, imports).then(output => {\n          callback(output.instance, output.module);\n        });\n      });\n    });\n    return {};\n  };}\n\n\n/**\n  * Returns the path of the WASM binary.\n  */\n @param\n  simdSupported whether SIMD is supported\n  @param\n  threadsSupported whether multithreading is supported\n  @param\n  wasmModuleFolder the directory containing the WASM binaries.\n  */\n\nfunction getPathToWasmBinary(\n  simdSupported: boolean, threadsSupported: boolean,\n  wasmModuleFolder: string) {\n  if (wasmPath !== null) {\n    // If wasmPath is defined, the user has supplied a full path to\n    // the vanilla .wasm binary.\n    return\n      wasmPath;\n  }\n\n  let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n  if (simdSupported &&\n    threadsSupported) {\n    path = 'tfjs-backend-wasm-threaded-simd.wasm';\n  } else if (simdSupported) {\n    path =\n      'tfjs-backend-wasm-simd.wasm';\n  }\n\n  if (wasmFileMap !== null) {\n    if (wasmFileMap[path] !== null) {\n      return\n        wasmFileMap[path];\n    }\n  }\n\n  return\n    wasmModuleFolder + path;\n}\n\n\n/**\n  * Initializes the wasm\n  module and creates the js <--> wasm bridge.\n  */\n * NOTE: We wrap the wasm module in a object with property\n  'wasm' instead of\n  * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n  * in\n  Chrome 76).\n  */\n\nexport async function init(): Promise<{wasm: BackendWasmModule}> {\n  const\n    [simdSupported, threadsSupported] = await Promise.all([\n    env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n    env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n  ]);\n\n  return\n    new Promise((resolve, reject) =>\n    {\n      const\n        factoryConfig: WasmFactoryConfig = {};\n\n      /**\n       * This function overrides the Emscripten\n       module locateFile utility.\n       */\n      @param\n        path The relative path to the file that needs to be loaded.\n      @param\n        prefix The path to the main JavaScript file's directory.\n      */\n      factoryConfig.locateFile = (path, prefix) => {\n        if (path.endsWith('.worker.js')) {\n          const\n            response = wasmWorkerContents;\n          const\n            blob = new\n              Blob([response], {type: 'application/javascript'});\n          return\n            URL.createObjectURL(blob);\n        }\n\n        if\n          (path.endsWith('.wasm')) {\n          return\n            getPathToWasmBinary(\n              simdSupported as boolean,\n              threadsSupported as boolean,\n              wasmPathPrefix !== null ?\n                wasmPathPrefix :\n                prefix);\n        }\n\n        return\n          prefix\n          + path;\n      };\n\n      // Use the instantiateWasm override when system fetch is not available.\n      // Reference:\n      //

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https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170

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if (customFetch) {\n  factoryConfig.instantiateWasm =\n  createInstantiateWasmFunc(getPathToWasmBinary(\n    simdSupported as boolean, threadsSupported as\n    boolean,\n    wasmPathPrefix != null ? wasmPathPrefix : ''));\n  }\n  let initialized = false;\n  factoryConfig.onAbort = () => {\n    if (initialized) {\n      // Emscripten already called console.warn so no need to\n      double log.\n      return;\n    }\n    if (initAborted) {\n      // Emscripten calls `onAbort` twice, resulting in double\n      error\n      // messages.\n      return;\n    }\n    initAborted = true;\n    const rejectMsg =\n      'Make sure the\n      server can serve the `.wasm` file relative to the '+\n      'bundled js file. For more details see\n      https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n    reject({message: rejectMsg});\n  };\n  let wasm: Promise<BackendWasmModule>;\n  // If `wasmPath` has\n  been defined we must initialize the vanilla module.\n  if (threadsSupported && simdSupported && wasmPath ==\n  null) {\n    factoryConfig.mainScriptUrlOrBlob = new Blob([\n      [var WasmBackendModuleThreadedSimd =\n      +\n      wasmFactoryThreadedSimd.toString()],\n      {type: 'text/javascript'}]);\n    wasm =\n    wasmFactoryThreadedSimd(factoryConfig);\n  } else {\n    // The wasmFactory works for both vanilla and SIMD\n    binaries.\n    wasm = wasmFactory(factoryConfig);\n  }\n  // The WASM module has been successfully\n  created by the factory.\n  // Any error will be caught by the onAbort callback defined above.\n  wasm.then((module) => {\n    initialized = true;\n    initAborted = false;\n    const voidReturnType: string =\n    null;\n    // Using the tfjs namespace to avoid conflict with emscripten's API.\n    module.tfjs = {\n      init:\n      module.cwrap('init', null, []),\n      initWithThreadCount:\n      module.cwrap('init_with_threads_count', null,\n      ['number']),\n      getThreadCount: module.cwrap('get_threads_count', 'number', []),\n      registerTensor:\n      module.cwrap(\n      'register_tensor', null, [\n      'number', // id\n      'number', // size\n      'number', // memoryOffset\n      ]),\n      disposeData: module.cwrap('dispose_data', voidReturnType,\n      ['number']),\n      dispose: module.cwrap('dispose', voidReturnType, []),\n    };\n    resolve({wasm: module});\n  });\n}\n\nfunction typedArrayFromBuffer(buffer: ArrayBuffer, dtype: DataType):\nbackend_util.TypedArray {\n  switch (dtype) {\n    case 'float32':\n      return new Float32Array(buffer);\n    case\n'int32':\n      return new Int32Array(buffer);\n    case 'bool':\n      return new Uint8Array(buffer);\n    default:\n      throw new Error(`Unknown dtype ${dtype}`);\n  }\n}\n\nconst wasmBinaryNames = [\n  'tfjs-backend-wasm.wasm',\n  'tfjs-backend-wasm-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\ntype\nWasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:\nstring = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet\ncustomFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file\n which will be fetched when the wasm\n * backend is initialized. See\n *  

https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more\n details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch\n to download\n * the wasm file, default to false.\n * @doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n  'setWasmPath has been deprecated in favor of setWasmPaths and '+\n  ' ' will be removed in a future release.);\n  if\n  (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call '+\n      '\n      `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n  }\n  wasmPath = path;\n  customFetch =\n  usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n * @param js\n * setWasmPaths({\n * 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n * 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n */\n\n/**\n * @param prefixOrFileMap This can be either a string or object.\n * - (string) The path to the directory\n where the WASM binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located\n in the same directory, or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional

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boolean to use platform fetch to download\n *   the wasm file, default to false.\n *\n * @doc {heading:
'Environment', namespace: 'wasm'}\n *\nexport function setWasmPaths(\n  prefixOrFileMap: string|{\n key in
WasmBinaryName}?: string),\n  usePlatformFetch = false): void {\n  if (initAborted) {\n    throw new Error(\n
'The WASM backend was already initialized. Make sure you call ' +\n    `setWasmPaths()` before you call
`tf.setBackend()` or ' +\n    `tf.ready()`);\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix
= prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths =\n    wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n    if (missingPaths.length > 0) {\n    throw new
Error(\n      `There were no entries found for the following binaries: ` +\n      `${missingPaths.join(',')}`. Please
either call setWasmPaths with a ` +\n      `map providing a path for each binary, or with a string indicating ` +\n
      `the directory where all the binaries can be found.`);\n    }\n  }\n  customFetch = usePlatformFetch;\n}\n\n/**
Used in unit tests. *\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n
wasmFileMap = {};\n  customFetch = false;\n  initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n *\n * This must be called before calling
`tf.setBackend('wasm')`.\n *\nexport function setThreadsCount(numThreads: number) {\n  threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n *\n * It is set after the
backend is initialized.\n *\nexport function getThreadsCount(): number {\n  if (actualThreadsCount === -1) {\n
throw new Error('WASM backend not initialized.);\n  }\n  return actualThreadsCount;\n}\n\n",/** @license See the
LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\nconst version = '3.11.0';\nexport
{version};\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n  const {wasm} = await init();\n  return new
BackendWasm(wasm);\n},
WASM_PRIORITY);\n\n], "names": ["setup", "wasmFunc", "sliceImplCPU", "concatImplCPU", "supportsFullBroadcas
t", "setupFunc", "kernelFunc", "rangeImplCPU", "require$$0", "require$$1", "require$$2", "global", "require$$3", "requir
e$$4", "wasmFactoryThreadedSimd", "wasmFactory"], "mappings": ";;;;;;;;;;AAAA;;;;;;;;;;AAiBA;AAC
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Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.js.map

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

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License.\n *

```
=====\n*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { slice } from  
 './Slice';\nfunction unpack(\n  args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n  TensorInfo[] {\n  const { inputs, backend, attrs } = args;\n  const { value } = inputs;\n  let { axis } = attrs;\n  if (axis <  
0) {\n    axis += value.shape.length;\n  }\n  const numOutputs = value.shape[axis];\n  const rank =  
value.shape.length;\n  const outShape: number[] = new Array(rank - 1);\n  let outIndex = 0;\n  for (let i = 0; i < rank;  
i++) {\n    if (i !== axis) {\n      outShape[outIndex++] = value.shape[i];\n    }\n    const outs: TensorInfo[] = new  
Array(numOutputs);\n    const begin = new Array(rank).fill(0);\n    const size = value.shape.slice();\n    size[axis] = 1;\n    for (let i = 0; i < outs.length; i++) {\n      begin[axis] = i;\n      outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },  
backend});\n    }\n    return outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n  }\n  \n  export const  
unpackConfig: KernelConfig = {\n    kernelName: Unpack,\n    backendName: 'wasm',\n    kernelFunc: unpack as { } as  
KernelFunc,\n  };\n}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.js.map

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* =====*/

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Floor.cc

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/unary.cc

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/FlipLeftRight.cc

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* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/NonMaxSuppressionV4.cc

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Neg.cc

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/batch_mat_mul_impl.cc

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/PadV2_test.cc

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

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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cos.js.map

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

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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"]}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cosh.js.map

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AE,KAAK;IACjB,WAAW,EAAE,MAAM;IACnB,UAAU,EAAE,KAAyB;CACtC,CAAC", "sourcesContent": ["/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n *\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const range =\n  (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n    const { backend, attrs } = args;\n    const { start, stop, step, dtype } = attrs;\n    const values = rangeImplCPU(start, stop, step, dtype);\n    const out = backend.makeOutput([values.length], dtype);\n    const outVals = backend.toArrayFromHeap(out);\n    outVals.set(values);\n    return out;\n  };\n\nexport const rangeConfig: KernelConfig = {\n  kernelName: Range,\n  backendName: 'wasm',\n  kernelFunc: range as { } as KernelFunc\n};\n\n}}
```

Found in path(s):

* /opt/cola/permits/1234600203_1638277742.68/0/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.js.map

1.181 libjpeg 6b

1.181.1 Notifications :

This software is based in part on the work of the Independent JPEG Group.

1.181.2 Available under license :

The Independent JPEG Group's JPEG software

=====
README for release 6b of 27-Mar-1998
=====

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

Serious users of this software (particularly those incorporating it into larger programs) should contact IJG at jpeg-info@uunet.uu.net to be added to our electronic mailing list. Mailing list members are notified of updates and have a chance to participate in technical discussions, etc.

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

IJG is not affiliated with the official ISO JPEG standards committee.

DOCUMENTATION ROADMAP

=====

This file contains the following sections:

OVERVIEW General description of JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.
RELATED SOFTWARE Other stuff you should get.
FILE FORMAT WARS Software *not* to get.
TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.doc How to configure and install the IJG software.
usage.doc Usage instructions for cjpeg, djpeg, jpegtran,
 rdjpgcom, and wrjpgcom.
*.1 Unix-style man pages for programs (same info as usage.doc).
wizard.doc Advanced usage instructions for JPEG wizards only.
change.log Version-to-version change highlights.

Programmer and internal documentation:

libjpeg.doc How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.doc Overview of the JPEG library's internal structure.
filelist.doc Road map of IJG files.
coderules.doc Coding style rules --- please read if you contribute code.

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

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

OVERVIEW

=====

This package contains C software to implement JPEG image compression and decompression. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and gray-scale images. JPEG is intended for compressing "real-world" scenes; line drawings, cartoons and other non-realistic images

are not its strong suit. JPEG is lossy, meaning that the output image is not exactly identical to the input image. Hence you must not use JPEG if you have to have identical output bits. However, on typical photographic images, very good compression levels can be obtained with no visible change, and remarkably high compression levels are possible if you can tolerate a low-quality image. For more details, see the references, or just experiment with various compression settings.

This software implements JPEG baseline, extended-sequential, and progressive compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. For legal reasons, we are not distributing code for the arithmetic-coding variants of JPEG; see LEGAL ISSUES. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

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

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application. We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

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

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

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

It appears that the arithmetic coding option of the JPEG spec is covered by patents owned by IBM, AT&T, and Mitsubishi. Hence arithmetic coding cannot legally be used without obtaining one or more licenses. For this reason, support for arithmetic coding has been removed from the free JPEG software. (Since arithmetic coding provides only a marginal gain over the unpatented Huffman mode, it is unlikely that very many implementations will support it.) So far as we are aware, there are no patent restrictions on the remaining code.

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

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REFERENCES

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

The best short technical introduction to the JPEG compression algorithm is Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PostScript file containing a revised version of Wallace's article is available at <ftp://ftp.uu.net/graphics/jpeg/wallace.ps.gz>. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections

and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

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

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

The JPEG standard itself is not available electronically; you must order a paper copy through ISO or ITU. (Unless you feel a need to own a certified official copy, we recommend buying the Pennebaker and Mitchell book instead; it's much cheaper and includes a great deal of useful explanatory material.) In the USA, copies of the standard may be ordered from ANSI Sales at (212) 642-4900, or from Global Engineering Documents at (800) 854-7179. (ANSI doesn't take credit card orders, but Global does.) It's not cheap: as of 1992, ANSI was charging \$95 for Part 1 and \$47 for Part 2, plus 7% shipping/handling. The standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

Some extensions to the original JPEG standard are defined in JPEG Part 3, a newer ISO standard numbered ISO/IEC IS 10918-3 and ITU-T T.84. IJG currently does not support any Part 3 extensions.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, revision 1.02. A copy of the JFIF spec is available from:

Literature Department
C-Cube Microsystems, Inc.
1778 McCarthy Blvd.
Milpitas, CA 95035
phone (408) 944-6300, fax (408) 944-6314

A PostScript version of this document is available by FTP at

<ftp://ftp.uu.net/graphics/jpeg/jfif.ps.gz>. There is also a plain text version at <ftp://ftp.uu.net/graphics/jpeg/jfif.txt.gz>, but it is missing the figures.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <ftp.sgi.com> or from <ftp://ftp.uu.net/graphics/jpeg/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note. libtiff is available from <ftp://ftp.sgi.com/graphics/tiff/>.

ARCHIVE LOCATIONS

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The "official" archive site for this software is <ftp.uu.net> (Internet address 192.48.96.9). The most recent released version can always be found there in directory `graphics/jpeg`. This particular version will be archived as <ftp://ftp.uu.net/graphics/jpeg/jpegsrc.v6b.tar.gz>. If you don't have direct Internet access, UUNET's archives are also available via UUCP; contact help@uunet.uu.net for information on retrieving files that way.

Numerous Internet sites maintain copies of the UUNET files. However, only <ftp.uu.net> is guaranteed to have the latest official version.

You can also obtain this software in DOS-compatible "zip" archive format from the SimTel archives (<ftp://ftp.simtel.net/pub/simtelnet/msdos/graphics/>), or on CompuServe in the Graphics Support forum (GO CIS:GRAPHSUP), library 12 "JPEG Tools". Again, these versions may sometimes lag behind the <ftp.uu.net> release.

The JPEG FAQ (Frequently Asked Questions) article is a useful source of general information about JPEG. It is updated constantly and therefore is not included in this distribution. The FAQ is posted every two weeks to Usenet newsgroups `comp.graphics.misc`, `news.answers`, and other groups. It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/> and other `news.answers` archive sites, including the official `news.answers` archive at rtfm.mit.edu: <ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/>. If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu with body

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

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

RELATED SOFTWARE

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Numerous viewing and image manipulation programs now support JPEG. (Quite a few of them use this library to do so.) The JPEG FAQ described above lists some of the more popular free and shareware viewers, and tells where to obtain them on Internet.

If you are on a Unix machine, we highly recommend Jef Poskanzer's free PBPLUS software, which provides many useful operations on PPM-format image files. In particular, it can convert PPM images to and from a wide range of other formats, thus making cjpeg/djpeg considerably more useful. The latest version is distributed by the NetPBM group, and is available from numerous sites, notably <ftp://wuarchive.wustl.edu/graphics/graphics/packages/NetPBM/>. Unfortunately PBPLUS/NETPBM is not nearly as portable as the IJG software is; you are likely to have difficulty making it work on any non-Unix machine.

A different free JPEG implementation, written by the PVRG group at Stanford, is available from <ftp://havefun.stanford.edu/pub/jpeg/>. This program is designed for research and experimentation rather than production use; it is slower, harder to use, and less portable than the IJG code, but it is easier to read and modify. Also, the PVRG code supports lossless JPEG, which we do not. (On the other hand, it doesn't do progressive JPEG.)

FILE FORMAT WARS

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Some JPEG programs produce files that are not compatible with our library. The root of the problem is that the ISO JPEG committee failed to specify a concrete file format. Some vendors "filled in the blanks" on their own, creating proprietary formats that no one else could read. (For example, none of the early commercial JPEG implementations for the Macintosh were able to exchange compressed files.)

The file format we have adopted is called JFIF (see REFERENCES). This format has been agreed to by a number of major commercial JPEG vendors, and it has become the de facto standard. JFIF is a minimal or "low end" representation. We recommend the use of TIFF/JPEG (TIFF revision 6.0 as modified by TIFF Technical Note #2) for "high end" applications that need to record a lot of additional data about an image. TIFF/JPEG is fairly new and not yet widely supported, unfortunately.

The upcoming JPEG Part 3 standard defines a file format called SPIFF. SPIFF is interoperable with JFIF, in the sense that most JFIF decoders should be able to read the most common variant of SPIFF. SPIFF has some technical advantages over JFIF, but its major claim to fame is simply that it is an

official standard rather than an informal one. At this point it is unclear whether SPIFF will supersede JFIF or whether JFIF will remain the de-facto standard. IJG intends to support SPIFF once the standard is frozen, but we have not decided whether it should become our default output format or not. (In any case, our decoder will remain capable of reading JFIF indefinitely.)

Various proprietary file formats incorporating JPEG compression also exist. We have little or no sympathy for the existence of these formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, open format standards for JPEG files. Don't use a proprietary file format!

TO DO

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The major thrust for v7 will probably be improvement of visual quality. The current method for scaling the quantization tables is known not to be very good at low Q values. We also intend to investigate block boundary smoothing, "poor man's variable quantization", and other means of improving quality-vs-file-size performance without sacrificing compatibility.

In future versions, we are considering supporting some of the upcoming JPEG Part 3 extensions --- principally, variable quantization and the SPIFF file format.

As always, speeding things up is of great interest.

Please send bug reports, offers of help, etc. to jpeg-info@uunet.uu.net.

1.182 jansi 1.8

1.182.1 Available under license :

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1.183 apache-http-server 2.4.53

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*/
/*
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* -----
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*/
```

For the test\zb.c component:

```
/*          ZeusBench V1.01
=====
```

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Written by Adam Twiss (adam@zeus.co.uk). March 1996

Thanks to the following people for their input:

Mike Belshe (mbelshe@netscape.com)

Michael Campanella (campanella@stevms.enet.dec.com)

```
*/
```

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```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en"><head>
<meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />
<!--
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X
    This file is generated from xml source: DO NOT EDIT
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X
    -->
<title>The Apache License, Version 2.0 - Apache HTTP Server Version 2.4</title>
<link href="/style/css/manual.css" rel="stylesheet" media="all" type="text/css" title="Main stylesheet" />
<link href="/style/css/manual-loose-100pc.css" rel="alternate stylesheet" media="all" type="text/css" title="No
Sidebar - Default font size" />
<link href="/style/css/manual-print.css" rel="stylesheet" media="print" type="text/css" /><link rel="stylesheet"
type="text/css" href="/style/css/prettify.css" />
<script src="/style/scripts/prettify.min.js" type="text/javascript">
</script>

<link href="/images/favicon.ico" rel="shortcut icon" /></head>
<body id="manual-page" class="no-sidebar"><div id="page-header">
<p class="menu"><a href="/mod/">Modules</a> | <a href="/mod/directives.html">Directives</a> | <a
href="http://wiki.apache.org/httpd/FAQ">FAQ</a> | <a href="/glossary.html">Glossary</a> | <a
href="/sitemap.html">Sitemap</a></p>
<p class="apache">Apache HTTP Server Version 2.4</p>
</div>
<div class="up"><a href="/"></a></div>
<div id="path">
```

[Apache](http://www.apache.org/) > [HTTP Server](http://httpd.apache.org/) > [Documentation](http://httpd.apache.org/docs/) > [Version 2.4](#)

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</div>

</div>

```
<div class="bottomlang">
```

```
<p><span>Available Languages: </span><a href="/en/license.html" title="English">&nbsp;en&nbsp;</a></p>
```

```
</div><div class="top"><a href="#page-header"></a></div><div
```

```
class="section"><h2><a id="comments_section" name="comments_section">Comments</a></h2><div
```

```
class="warning"><strong>Notice:</strong><br />This is not a Q&A section. Comments placed here should be pointed towards suggestions on improving the documentation or server, and may be removed by our moderators if they are either implemented or considered invalid/off-topic. Questions on how to manage the Apache HTTP Server should be directed at either our IRC channel, #httpd, on Libera.chat, or sent to our <a href="https://httpd.apache.org/lists.html">mailing lists</a></div>
```

```
<script type="text/javascript"><!--<!--><![CDATA[</script><!--</script>
```

```
var comments_shortcode = 'httpd';
```

```
var comments_identifier = 'http://httpd.apache.org/docs/2.4/license.html';
```

```
(function(w, d) {
```

```
  if (w.location.hostname.toLowerCase() === "httpd.apache.org") {
```

```
    d.write('<div id="comments_thread"></div>');
```

```
    var s = d.createElement('script');
```

```
    s.type = 'text/javascript';
```

```
    s.async = true;
```

```
    s.src = 'https://comments.apache.org/show_comments.lua?site=' + comments_shortcode + '&page=' +
```

```
comments_identifier;
```

```
    (d.getElementsByTagName('head')[0] || d.getElementsByTagName('body')[0]).appendChild(s);
```

```
  }
```

```
  else {
```

```
    d.write('<div id="comments_thread">Comments are disabled for this page at the moment.</div>');
```

```
}
})(window, document);

```

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1.184 jackson-databind 2.11.2

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1.185 libjpeg-turbo 2.0.3

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Why Three Licenses?

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1.186 swagger-annotations 1.5.22

1.186.1 Available under license :

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*/

package io.swagger.annotations;

import java.lang.annotation.ElementType;

import java.lang.annotation.Retention;

import java.lang.annotation.RetentionPolicy;

```

import java.lang.annotation.Target;

/**
 * License metadata available within the info section of a Swagger definition, see
 * https://github.com/OAI/OpenAPI-Specification/blob/master/versions/2.0.md#licenseObject
 *
 * @since 1.5.0
 */

@Target(ElementType.ANNOTATION_TYPE)
@Retention(RetentionPolicy.RUNTIME)
public @interface License {

    /**
     * The name of the license.
     *
     * @return the name of the license
     */
    String name();

    /**
     * An optional URL for the license.
     *
     * @return an optional URL for the license.
     */
    String url() default "";
}

```

1.187 pytz 2022.1

1.187.1 Available under license :

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1.188 jakarta-validation-api 2.0.2

1.188.1 Available under license :

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

```
/*  
* Jakarta Bean Validation API  
*  
* License: Apache License, Version 2.0  
* See the license.txt file in the root directory or <http://www.apache.org/licenses/LICENSE-2.0>.  
*/
```

Found in path(s):

```
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Validator.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/CascadableDescriptor.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintTarget.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/FutureOrPresent.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Null.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidatorContext.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ExecutableDescriptor.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/Default.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/MessageInterpolator.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/package-info.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/Unwrapping.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractor.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/ValidationTarget.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/MethodDescriptor.java  
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/package-info.java
```

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/UnexpectedTypeException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/BeanDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Digits.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/ProviderSpecificBootstrap.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/UnwrapByDefault.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NegativeOrZero.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintViolation.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintDefinitionException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ValidateUnwrappedValue.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/SupportedValidationTarget.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/package-info.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/ValidationProvider.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ElementKind.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/GroupConversionDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ExtractedValue.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/GenericBootstrap.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/MethodType.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDeclarationException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ConstructorDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/package-info.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/AssertTrue.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Path.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/package-info.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/package-info.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/PositiveOrZero.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractorDefinitionException.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ElementDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ContainerElementTypeDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/GroupDefinitionException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Min.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/ConvertGroup.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/Scope.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Max.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ReturnValueDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ParameterNameProvider.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Pattern.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/NoProviderFoundException.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidatorContext.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NotBlank.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/package-info.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Constraint.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Valid.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintViolationException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/package-info.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/ExecutableValidator.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidatorFactory.java

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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/package-info.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/GroupSequence.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Negative.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidatorFactory.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidationException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/OverridesAttribute.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/BootstrapState.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Email.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintDeclarationException.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/PropertyDescriptor.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidator.java

* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/ExecutableType.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/AssertFalse.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Future.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/DecimalMax.java
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* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NotEmpty.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/ConfigurationState.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Payload.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/DecimalMin.java
* /opt/cola/permits/1135880235_1613624044.2/0/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Past.java

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1.189 ehcache-107 3.8.1

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* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/Js107ServiceConfigurationParser.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/ConfigurationMerger.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/Js107Configuration.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/package-info.java
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* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107IdentityCopier.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/Js107CacheConfiguration.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Js107Service.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/EhcacheCachingProvider.java
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* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheLoaderWriter.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/EventListenerAdaptors.java
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* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/DefaultConfigurationResolver.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheMXBean.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107ReverseConfiguration.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/package-info.java
* /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-

jar/org/ehcache/jsr107/Eh107Expiry.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
 jar/org/ehcache/jsr107/Eh107CompleteConfiguration.java
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 jar/org/ehcache/jsr107/EhcacheExpiryWrapper.java
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 jar/org/ehcache/jsr107/internal/Js107CacheLoaderWriter.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
 jar/org/ehcache/jsr107/Eh107CacheEntryEvent.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
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 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
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 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/CloseUtil.java
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 jar/org/ehcache/jsr107/internal/tck/Eh107MBeanServerBuilder.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
 jar/org/ehcache/jsr107/internal/DefaultJs107Service.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
 jar/org/ehcache/jsr107/Eh107Cache.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
 jar/org/ehcache/jsr107/internal/WrappedCacheLoaderWriter.java
 * /opt/cola/permits/1258059359_1643027217.37/0/ehcache-107-3-8-1-sources-
 jar/org/ehcache/jsr107/ListenerResources.java

1.190 openssl 1.1.1m

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```
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Copyright (C) 19yy <name of author>
```

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```
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This is free software, and you are welcome to redistribute it
```

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``Gnomovision'` (which makes passes at compilers) written by James Hacker.

<signature of Ty Coon>, 1 April 1989

Ty Coon, President of Vice

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The End

1.191 luuid 1.0

1.191.1 Available under license :

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```
/*
 * wuuid.c
 *
 * Emulation of libuuid.so API functions based on the native Windows
 * API. Only those functions actually used by luuid are provided.
 * Extending this work to a complete emulation of libuuid would be
 * possible, but of unknown value.
 *
 * Implemented by Ross Berteig <Ross@cheshireeng.com>
 * Released 2007-09-24.
 * This code is hereby placed in the public domain.
 */
```

Found in path(s):

```
*/opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/wuuid.c
```

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

--- This dist file is part of LuaDist project

-- status:

name="luuid"

version="5.1.0.20101118"

desc = "A library for UUID generation"

author = "Luiz Henrique de Figueiredo"

url = "http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/#luuid"

license = "Public domain"

maintainer = "Peter Kapec"

dependencies = {

"lua ~> 5.1",

```
Linux = {  
  "uuid-dev >- 2.16"  
}  
}
```

Found in path(s):

```
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/dist.info  
No license file was found, but licenses were detected in source scan.
```

```
/*  
* luuid.c  
* uuid interface for Lua 5.1  
* Luiz Henrique de Figueiredo <lhf@tecgraf.puc-rio.br>  
* 18 Nov 2010 19:16:20  
* This code is hereby placed in the public domain.  
*/
```

Found in path(s):

```
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/luuid.c  
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```

This is a uuid library for Lua 5.1. It generates Universally Unique Identifiers using libuuid, which is part of the e2fsprogs package and is available at <http://e2fsprogs.sourceforge.net/>
If you're running Linux, libuuid is probably already installed.

To try the library, just edit Makefile to reflect your installation of Lua and possibly of libuuid. Then run make. This will build the library and run a simple test. For detailed installation instructions, see <http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/install.html>

There is no manual but the library is simple and intuitive; see the summary below. Read also test.lua, which shows the library in action.

This code is hereby placed in the public domain.
Please send comments, suggestions, and bug reports to lhf@tecgraf.puc-rio.br .

```
-----  
uuid library:  
isvalid(s) new([s]) time(s) version  
-----
```

Found in path(s):

```
* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/README  
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```

BSD license.

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* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/FindUUID.cmake
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/*

* wuuid.h

*

* Emulation of libuuid.so API functions based on the native Windows

* API. Only those functions actually used by luuid are provided.

* Extending this work to a complete emulation of libuuid would be

* possible, but of unknown value.

*

* Implemented by Ross Berteig <Ross@cheshireeng.com>

* Released 2007-09-24.

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*/

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Found in path(s):

* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/CMakeLists.txt

* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/luu.cmake

* /opt/cola/permits/1547567072_1675150749.62692/0/tp-luuid-1-051b6bb2c564-zip/cmake/dist.cmake

1.192 libpng 1.6.37

1.192.1 Available under license :

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pnm2png / png2pnm --- conversion from PBM/PGM/PPM-file to PNG-file

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1.193 e2fsprogs 1.43.7

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*/

Index: tdbsa/tdb.c

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

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

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

*/

/*

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

- trivial database library - private includes
-
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written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

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

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

```
all:: image
```

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

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

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

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

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

```
install-strip: install
```

```
install-shlibs-strip: install-shlibs
```

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

```
clean::
```

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

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

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Theodore Ts'o

23-June-2007

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```
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```
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1.194 tzdata 2022.1

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1.198 acpid 2.0.27

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1.199 log4j-api 2.13.3

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Contributors to bttv:

Michael Chu <mmchu@pobox.com>
AverMedia fix and more flexible card recognition

Alan Cox <alan@lxorguk.ukuu.org.uk>
Video4Linux interface and 2.1.x kernel adaptation

Chris Kleitsch
Hardware I2C

Gerd Knorr <kraxel@cs.tu-berlin.de>
Radio card (ITT sound processor)

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

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

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated

interface definition files, plus the scripts used to control compilation and installation of the library.

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must

be optional: if the application does not supply it, the square root function must still compute square roots.)

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

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- b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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```
/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)
* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)
*
* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.
* http://www.hypermall.com/
* 10/1/97 - commented out CFG_PHYIE bit - we don't care when the PHY
* interrupts us (except possibly for removal/insertion of the cable?)
* 10/4/97 - began heavy inline documentation of the code. Corrected typos
* and spelling mistakes.
* 10/5/97 - added code to handle PHY interrupts, disable PHY on
* loss of link, and correctly re-enable PHY when link is
* re-established. (put back CFG_PHYIE)
*
* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.
*
* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997
*
* Linux driver for the IDT77201 NICStAR PCI ATM controller.
* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;
* see init_nicstar() for PHY initialization to change this. This driver
* expects the Linux ATM stack to support scatter-gather lists
* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.
*
```



```

* Implementing minimal-copy of received data:
* IDT always receives data into a small buffer, then large buffers
* as needed. This means that data must always be copied to create
* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
* Fix is simple: make large buffers large enough to hold entire
* SDU, and leave <small_buffer_data> bytes empty at the start. Then
* copy small buffer contents to head of large buffer.
* Trick is to avoid fragmenting Linux, due to need for a lot of large
* buffers. This is done by 2 things:
* 1) skb->destructor / skb->atm.recycle_buffer
*    combined, allow nicstar_free_rx_skb to be called to
*    recycle large data buffers
* 2) skb_clone of received buffers
* See nicstar_free_rx_skb and linearize_buffer for implementation
* details.
*
*
*
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* Foundation, Inc., 675 Mass Ave, Cambridge, MA 02139, USA.
*
* M. Welsh, 6 July 1996
*
*
*/

```

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Thanks go to the following people for patches and contributions:

Michael Hunold <m.hunold@gmx.de>
for the initial saa7146 driver and its recent overhaul

Christian Theiss
for his work on the initial Linux DVB driver

Marcus Metzler <mocm@metzlerbros.de>
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for their continuing work on the DVB driver

Michael Holzt <kju@debian.org>
for his contributions to the dvb-net driver

Diego Picciani <d.picciani@novacomp.it>
for CyberLogin for Linux which allows logging onto EON
(in case you are wondering where CyberLogin is, EON changed its login procedure and CyberLogin is no longer used.)

Martin Schaller <martin@smurf.franken.de>
for patching the cable card decoder driver

Klaus Schmidinger <Klaus.Schmidinger@cadsoft.de>
for various fixes regarding tuning, OSD and CI stuff and his work on VDR

Steve Brown <sbrown@cortland.com>

for his AFC kernel thread

Christoph Martin <martin@uni-mainz.de>
for his LIRC infrared handler

Andreas Oberritter <obi@linuxtv.org>
Dennis Noermann <dennis.noermann@noernet.de>
Felix Domke <tmbinc@elitedvb.net>
Florian Schirmer <jolt@tuxbox.org>
Ronny Strutz <3des@elitedvb.de>
Wolfram Joost <dbox2@frokaschwei.de>
...and all the other dbox2 people
for many bugfixes in the generic DVB Core, frontend drivers and
their work on the dbox2 port of the DVB driver

Oliver Endriss <o.endriss@gmx.de>
for many bugfixes

Andrew de Quincey <adq_dvb@lidskialf.net>
for the tda1004x frontend driver, and various bugfixes

Peter Schildmann <peter.schildmann@web.de>
for the driver for the Technisat SkyStar2 PCI DVB card

Vadim Catana <skystar@moldova.cc>
Roberto Ragusa <r.ragusa@libero.it>
Augusto Cardoso <augusto@carhil.net>
for all the work for the FlexCopII chipset by B2C2,Inc.

Davor Emard <emard@softhome.net>
for his work on the budget drivers, the demux code,
the module unloading problems, ...

Hans-Frieder Vogt <hfvogt@arcor.de>
for his work on calculating and checking the crc's for the
TechnoTrend/Hauppage DEC driver firmware

Michael Dreher <michael@5dot1.de>
Andreas 'randy' Weinberger
for the support of the Fujitsu-Siemens Activy budget DVB-S

Kenneth Aafly <ke-aa@frisurf.no>
for adding support for Typhoon DVB-S budget card

Ernst Peinlich <e.peinlich@inode.at>
for tuning/DiSEqC support for the DEC 3000-s

Peter Beutner <p.beutner@gmx.net>

for the IR code for the ttusb-dec driver

Wilson Michaels <wilsonmichaels@earthlink.net>
for the lgdt330x frontend driver, and various bugfixes

Michael Krufky <mkrufky@linuxtv.org>
for maintaining v4l/dvb inter-tree dependencies

Taylor Jacob <rtjacob@earthlink.net>
for the nxt2002 frontend driver

Jean-Francois Thibert <jeanfrancois@sagetv.com>
for the nxt2004 frontend driver

Kirk Lapray <kirk.lapray@gmail.com>
for the or51211 and or51132 frontend drivers, and
for merging the nxt2002 and nxt2004 modules into a
single nxt200x frontend driver.

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- */

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- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/eviction/EvictionListener.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/DebuggingUtils.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/Allocator.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/BinaryStorageEngine.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapHashMap.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/Portability.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentPortability.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableSegment.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/exceptions/OversizeMappingException.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/WriteLockedOffHeapHashMap.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/Validation.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableCache.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/HeapBufferSource.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/OffHeapBufferSource.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/Page.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/Persistent.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentStorageEngine.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/PageSource.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/RuntimeStorageEngineListener.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/ByteArrayPortability.java
- * /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-

jar/org/terracotta/offheapstore/storage/portability/BooleanPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/Metadata.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/WriteLockedOffHeapClockCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/portability/PersistentSerializablePortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentOffHeapCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/listener/RecoveryStorageEngineListener.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/Region.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/ByteBufferInputStream.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentHalfStorageEngine.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/portability/PersistentByteArrayPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/Factory.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapHashMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/listener/StorageEngineListener.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/paging/MappedPage.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/buffersource/BufferSource.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/NoOpLock.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/portability/WriteContext.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/portability/WriteBackPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/portability/StringPortability.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentLockedOffHeapHashMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/listener/ListenableStorageEngine.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/MapInternals.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/paging/UnlimitedPageSource.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-

```
jar/org/terracotta/offheapstore/storage/allocator/IntegerBestFitAllocator.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/util/MemoryUnit.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapClockCache.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapMap.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/storage/allocator/Region.java
* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ConcurrentMapInternals.java
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* /opt/cola/permits/1258059374_1643027386.0/0/offheap-store-2-4-3-sources-jar/META-
INF/maven/org.terracotta/offheap-store/pom.xml

1.203 icu 66.1 2ubuntu2.1

1.203.1 Available under license :

```
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## BSD-specific setup (FreeBSD, OpenBSD, NetBSD, *BSD)
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## Commands to generate dependency files
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)
GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)

## Flags for position independent code
```

```

SHAREDLIBCFLAGS = -fPIC
SHAREDLIBCXXFLAGS = -fPIC
SHAREDLIBCPPFLAGS = -DPIC

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

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

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

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

## Shared object suffix
SO = so
## Non-shared intermediate object suffix
STATIC_O = ao

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

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

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

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

```

Versioned libraries rules

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

Bind internal references

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

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

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

End BSD-specific setup

This package was debianized by Jay Berkenbilt <qjb@debian.org> on August 5, 2005.

The packaging was taken over by Laszlo Boszormenyi (GCS) <gcs@debian.org> on Tue, 17 Mar 2015.

The original source was downloaded from <http://site.icu-project.org/download>

The main web site for ICU is <http://www.icu-project.org/>

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1.208 ffmpeg 4.3.1

1.208.1 Available under license :

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Specifically, the GPL parts of FFmpeg are:

- libpostproc
- optional x86 optimization in the files
 - `libavcodec/x86/flac_dsp_gpl.asm`
 - `libavcodec/x86/idct_mmx.c`
 - `libavfilter/x86/vf_removegrain.asm`
- the following building and testing tools
 - `compat/solaris/make_sunver.pl`
 - `doc/t2h.pm`
 - `doc/texi2pod.pl`
 - `libswresample/tests/swresample.c`
 - `tests/checkasm/*`
 - `tests/tiny_ssim.c`
- the following filters in libavfilter:
 - `signature_lookup.c`
 - `vf_blackframe.c`
 - `vf_boxblur.c`
 - `vf_colormatrix.c`
 - `vf_cover_rect.c`
 - `vf_croptdetect.c`
 - `vf_delogo.c`
 - `vf_eq.c`
 - `vf_find_rect.c`

```

- `vf_fspp.c`
- `vf_histeq.c`
- `vf_hqdn3d.c`
- `vf_kerndeint.c`
- `vf_lensfun.c` (GPL version 3 or later)
- `vf_mcdeint.c`
- `vf_mpdecimate.c`
- `vf_nnedi.c`
- `vf_owdenoise.c`
- `vf_perspective.c`
- `vf_phase.c`
- `vf_pp.c`
- `vf_pp7.c`
- `vf_pullup.c`
- `vf_repeatfields.c`
- `vf_sab.c`
- `vf_signature.c`
- `vf_smartblur.c`
- `vf_spp.c`
- `vf_stereo3d.c`
- `vf_super2xsai.c`
- `vf_tinterlace.c`
- `vf_uspp.c`
- `vf_vaguedenoiser.c`
- `vsrc_mptestsrc.c`

```

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

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

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

External libraries

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

Compatible libraries

The following libraries are under GPL version 2:

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

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

The following libraries are under LGPL version 3:

- gmp
- libaribb24
- liblensfun

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

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

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

Incompatible libraries

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

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1.209 commons-lang3 3.10

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The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in

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

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

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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

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

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5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

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Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

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Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

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TERMS AND CONDITIONS

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1.216 glib 2.28.8

1.217 nghttp2 1.40.0-1build1

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set yrange [0:]

set terminal pngcairo font 'Sans, 8' lw 1 size 1400,1024

set xtics rotate by -45

set style histogram errorbars gap 2 lw 1

set style fill solid border -1

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1.218 jul-to-slf4j 1.7.30

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- */

Found in path(s):

* /opt/cola/permits/1135864176_1613618002.1/0/jul-to-slf4j-1-7-30-sources-1-jar/org/slf4j/bridge/SLF4JBridgeHandler.java

1.219 linenoise 1.0

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1.220 protobuf 3.6.1.3-2ubuntu5

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

Original Protocol Buffers design and implementation:

Sanjay Ghemawat <sanjay@google.com>

Jeff Dean <jeff@google.com>

Daniel Dulitz <daniel@google.com>

Craig Silverstein

Paul Haahr <haahr@google.com>

Corey Anderson <corin@google.com>

(and many others)

Proto2 C++ and Java primary author:

Kenton Varda <kenton@google.com>

Proto2 Python primary authors:

Will Robinson <robinson@google.com>

Petar Petrov <petar@google.com>

Java Nano primary authors:

Brian Duff <bduff@google.com>
Tom Chao <chaot@google.com>
Max Cai <maxtroy@google.com>
Ulas Kirazci <ulas@google.com>

Large code contributions:

Jason Hsueh <jasonh@google.com>
Joseph Schorr <jschorr@google.com>
Wenbo Zhu <wenboz@google.com>

Large quantity of code reviews:

Scott Bruce <sbruce@google.com>
Frank Yellin
Neal Norwitz <nnorwitz@google.com>
Jeffrey Yasskin <jyasskin@google.com>
Ambrose Feinstein <ambrose@google.com>

Documentation:

Lisa Carey <lcarey@google.com>

Maven packaging:

Gregory Kick <gak@google.com>

Patch contributors:

Kevin Ko <kevin.s.ko@gmail.com>
* Small patch to handle trailing slashes in --proto_path flag.
Johan Euphrosine <propy@aminche.com>
* Small patch to fix Python CallMethod().
Ulrich Kunitz <kune@deine-taler.de>
* Small optimizations to Python serialization.
Leandro Lucarella <llucax@gmail.com>
* VI syntax highlighting tweaks.
* Fix compiler to not make output executable.
Dilip Joseph <dilip.antony.joseph@gmail.com>
* Heuristic detection of sub-messages when printing unknown fields in text format.
Brian Atkinson <nairb774@gmail.com>
* Added @Override annotation to generated Java code where appropriate.
Vincent Choinire <Choiniere.Vincent@hydro.qc.ca>
* Tru64 support.
Monty Taylor <monty.taylor@gmail.com>
* Solaris 10 + Sun Studio fixes.
Alek Storm <alek.storm@gmail.com>
* Slicing support for repeated scalar fields for the Python API.
Oleg Smolsky <oleg.smolsky@gmail.com>
* MS Visual Studio error format option.
* Detect unordered_map in stl_hash.m4.
Brian Olson <brianolson@google.com>

- * gzip/zlib I/O support.

Michael Poole <mdpoole@troilus.org>

- * Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
- * Added generation of field number constants.

Wink Saville <wink@google.com>

- * Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

- * Small patch improving performance of in Python serialization.

Alexandre Vassalotti <alexandre@peadrop.com>

- * Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>

- * Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>

- * HPUX support.

Oliver Jowett <oliver.jowett@gmail.com>

- * Detect whether zlib is new enough in configure script.
- * Fixes for Solaris 10 32/64-bit confusion.

Evan Jones <evanj@mit.edu>

- * Optimize Java serialization code when writing a small message to a stream.
- * Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
- * Clean up some Java warnings.
- * Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>

- * Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>

- * Fixed m4/acx_pthread.m4 problem for some Linux distributions.

William Orr <will@worrbase.com>

- * Fixed detection of sched_yield on Solaris.
- * Added atomicops for Solaris

Andrew Paprocki <andrew@ishiboo.com>

- * Fixed minor IBM xLC compiler build issues
- * Added atomicops for AIX (POWER)

1.221 unbound 1.13.2

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1.222 speex 1.2beta3

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1.223 syslinux 6.03

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*

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

*

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

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

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

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A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that,

in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

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

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

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However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit

modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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Ty Coon, President of Vice

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

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1.226 fribidi 1.0.11

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To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them

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Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free

library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

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If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to

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1.227 fastapi 0.68.2

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bzip2/libbzip2 version 1.0.4 of 20 December 2006

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1.230 popt 1.16

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1.232 spring-tx 5.2.20.RELEASE

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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionDefinition.java

* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/AnnotationTransactionAttributeSource.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionManager.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/AbstractTransactionStatus.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionProxyFactoryBean.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/MethodMapTransactionAttributeSource.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/SpringTransactionAnnotationParser.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/CompositeTransactionAttributeSource.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/GenericReactiveTransaction.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionOperations.java

* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionSynchronizationUtils.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/JtaTransactionAnnotationParser.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/ReactiveResourceSynchronization.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionAttributeEditor.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/Ejb3TransactionAnnotationParser.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionStatus.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/event/ApplicationListenerMethodTransactionalAdapter.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionAttributeSource.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/Propagation.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionAttribute.java
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jar/org/springframework/transaction/TransactionSystemException.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/BeanFactoryTransactionAttributeSourceAdvisor.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/object/EisOperation.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/TransactionAttributeSourceAdvisor.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/DataAccessResourceFailureException.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/connection/ConnectionSpecConnectionFactoryAdapter.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/support/SimpleBootstrapContext.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/DataRetrievalFailureException.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/core/support/CommAreaRecord.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/ConcurrencyFailureException.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/NonTransientDataAccessException.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/core/CciOperations.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/CallbackPreferringPlatformTransactionManager.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/TransientDataAccessException.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/TransactionCallbackWithoutResult.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/DataAccessException.java
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jar/org/springframework/jca/support/ResourceAdapterFactoryBean.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/context/ResourceAdapterApplicationContext.java
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jar/org/springframework/transaction/event/TransactionalEventListener.java
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jar/org/springframework/transaction/support/TransactionSynchronizationUtils.java
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jar/org/springframework/transaction/event/TransactionPhase.java
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jar/org/springframework/dao/annotation/PersistenceExceptionTranslationPostProcessor.java
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- * /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/JtaAfterCompletionSynchronization.java
- * /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DuplicateKeyException.java
- * /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionSynchronizationAdapter.java
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- * /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/DelegatingTransactionAttribute.java
- * /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/TypeMismatchDataAccessException.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/InvalidDataAccessApiUsageException.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/CannotCreateTransactionException.java
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jar/org/springframework/transaction/ReactiveTransactionManager.java
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jar/org/springframework/transaction/interceptor/RuleBasedTransactionAttribute.java
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jar/org/springframework/transaction/annotation/EnableTransactionManagement.java
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jar/org/springframework/jca/work/WorkManagerTaskExecutor.java

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jar/org/springframework/transaction/SavepointManager.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/core/InteractionCallback.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/object/MappingRecordOperation.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/support/DaoSupport.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/jca/context/BootstrapContextAware.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/jca/endpoint/AbstractMessageEndpointFactory.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/jca/endpoint/GenericMessageEndpointManager.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/support/CciDaoSupport.java
* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/event/TransactionalEventListenerFactory.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/config/AnnotationDrivenBeanDefinitionParser.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/TransactionManagementConfigurationSelector.java
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* /opt/cola/permits/1301486313_1649248830.06/0/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/IncorrectResultSizeDataAccessException.java

1.233 spring-web-mvc 5.2.20.RELEASE

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/ResourcesBeanDefinitionParser.java
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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/RequestMappingHandlerAdapter.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/ServerRequest.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceHttpRequestHandler.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/EncodedResourceResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateConfig.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBodyReturnValueHandler.java
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jar/org/springframework/web/servlet/handler/DispatcherServletWebRequest.java
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*/
/**
* A contract for inspecting and potentially modifying request data values such
* as URL query parameters or form field values before they are rendered by a
* view or before a redirect.
*
* <p>Implementations may use this contract for example as part of a solution
* to provide data integrity, confidentiality, protection against cross-site
* request forgery (CSRF), and others or for other tasks such as automatically
* adding a hidden field to all forms and URLs.
*
* <p>View technologies that support this contract can obtain an instance to
* delegate to via { @link RequestContext#getRequestDataValueProcessor() }.
*
* @author Rossen Stoyanchev
* @since 3.1
*/

Found in path(s):

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/support/RequestDataValueProcessor.java

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```
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/i18n/AcceptHeaderLocaleResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/PathResourceLookupFunction.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ExtendedServletRequestDataBinder.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerExceptionResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/support/RouterFunctionMapping.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdviceAdapter.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/support/DefaultHandlerExceptionResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/HandlerMappingIntrospector.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/MatchableHandlerMapping.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestMappingHandlerMapping.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/MvcUriComponentsBuilder.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/FreeMarkerConfigurerBeanDefinitionParser.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerMethodMapping.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/RequestPredicate.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
```

jar/org/springframework/web/servlet/mvc/method/annotation/ReactiveTypeHandler.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ResourceUrlProvider.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/FrameworkServlet.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdvice.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/RequestMappingInfoHandlerMapping.java
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jar/org/springframework/web/servlet/theme/AbstractThemeResolver.java
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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/freemarker/FreeMarkerViewResolver.java
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/**

* XSLT-driven View that allows for response context to be rendered as the

* result of an XSLT transformation.

*

* <p>The XSLT Source object is supplied as a parameter in the model and then

* { @link #locateSource detected} during response rendering. Users can either specify

* a specific entry in the model via the { @link #setSourceKey sourceKey} property or

* have Spring locate the Source object. This class also provides basic conversion

* of objects into Source implementations. See { @link #getSourceTypes() here}

* for more details.

*

* <p>All model parameters are passed to the XSLT Transformer as parameters.

* In addition the user can configure { @link #setOutputProperties output properties}

* to be passed to the Transformer.

*

* @author Rob Harrop

* @author Juergen Hoeller

* @since 2.0

*/

Found in path(s):

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/xslt/XsltView.java
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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/MvcNamespaceHandler.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/DefaultServletHandlerBeanDefinitionParser.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/Controller.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/AbstractTemplateView.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBody.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/SpringLocaleResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/condition/RequestCondition.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurerAdapter.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurerComposite.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceTransformer.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/ViewResolverComposite.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/InterceptorsBeanDefinitionParser.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/AbstractLocaleResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/theme/ThemeChangeInterceptor.java
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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsxView.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/VersionPathStrategy.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupViewResolver.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/ArgumentAware.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/HtmlEscapingAwareTag.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/VersionStrategy.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsxStreamingView.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/NoHandlerFoundException.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfig.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/UrlBasedViewResolverRegistration.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/FlashMapManager.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/SessionFlashMapManager.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/PasswordInputTag.java

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- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesViewResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/PathVariableMapMethodArgumentResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/ServletForwardingController.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/InternalResourceViewResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/LocaleContextResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/support/RedirectAttributesModelMap.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateViewResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/FlashMap.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/ViewControllerRegistration.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesView.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/ThemeResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/SessionLocaleResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/RequestAttributeMethodArgumentResolver.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/RequestToViewNameTranslator.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/EnableWebMvc.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/CallableMethodReturnValueHandler.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ServletWebArgumentResolverAdapter.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/HttpResource.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/Param.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/RedirectViewControllerRegistration.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/HandlerInterceptorAdapter.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/document/AbstractXlsView.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceResolver.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/AbstractLocaleContextResolver.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/freemarker/FreeMarkerConfig.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/UserRoleAuthorizationInterceptor.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/WebRequestHandlerInterceptorAdapter.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/theme/SessionThemeResolver.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/ResourceChainRegistration.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/JstlView.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ModelAndViewResolverMethodReturnValueHandler.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/FixedLocaleResolver.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/LocaleResolver.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/ParameterizableViewController.java

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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/groovy/GroovyMarkupView.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/JspAwareRequestContext.java

* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/ResourceHandlerRegistration.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ServletModelAttributeMethodProcessor.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/HttpHeadersReturnValueHandler.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/AsyncHandlerInterceptor.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesConfigurer.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/AbstractUrlBasedView.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ModelAndViewMethodReturnValueHandler.java
* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/AbstractResourceResolver.java
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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/SimpleServletPostProcessor.java
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* /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/SpringWildcardServletTilesApplicationContext.java

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- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/SmartView.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/SpringBeanPreparerFactory.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/AbstractDetectingUrlHandlerMapping.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/SimpleControllerHandlerAdapter.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/AbstractSpringPreparerFactory.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/LastModified.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/ParamAware.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/RadioButtonTag.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/support/RedirectAttributes.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/ConversionServiceExposingInterceptor.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/SimpleServletHandlerAdapter.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/OptionWriter.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/condition/MediaTypeExpression.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/TagIdGenerator.java
- * /opt/cola/permits/1301486303_1649248822.91/0/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/AbstractUrlViewController.java

1.234 ethtool 3.2

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The parts of the libtelnet that handle Kerberos.

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GSS-API mechlue layer.

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@heading Vincent Rijmen, Antoon Bosselaers, Paulo Barreto

AES in libcrypto

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rijndael-alg-fst.c

@version 3.0 (December 2000)

Optimised ANSI C code for the Rijndael cipher (now AES)

@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>

@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>

@author Paulo Barreto <paulo.barreto@terra.com.br>

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kdc/announce.c

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DES core in libcrypto

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D3DES (V5.09) -

A portable, public domain, version of the Data Encryption Standard.

Written with Symantec's THINK (Lightspeed) C by Richard Outerbridge. Thanks to: Dan Hoey for his excellent Initial and Inverse permutation code; Jim Gillogly & Phil Karn for the DES key schedule code; Dennis Ferguson, Eric Young and Dana How for comparing notes; and Ray Lau, for humouring me on.

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Windows support

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@heading Novell, Inc

lib/hcrypto/test_dh.c

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```
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```

<signature of Ty Coon>, 1 April 1989

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    </_>
  </_>
</trees>

```



```

<_>
<!-- tree 3 -->
<_>
  <!-- root node -->
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      <_>
        44 10 10 5 3.</_></rects>
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  <!-- tree 4 -->
  <_>
    <!-- root node -->
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        <_>
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        <!-- root node -->
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              2 3 43 2 3.</_></rects>
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```

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  <!-- root node -->
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      <>
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        36 4 7 4 2.</_>
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      <>
        14 15 49 1 2.</_></rects>
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```

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    <!-- tree 0 -->
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              <_>
                2 5 2 9 2.</_></rects>
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        <!-- tree 1 -->
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            <!-- root node -->
              <feature>
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                  <_>
                    21 3 38 2 2.</_></rects>
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            <!-- tree 2 -->
              <_>
                <!-- root node -->
                  <feature>
                    <rects>
                      <_>
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                      <_>
                        53 12 9 3 2.</_></rects>
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                  <_>
                <!-- tree 3 -->
                  <_>
                    <!-- root node -->

```

```

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    <_>
      13 4 3 3 3.</_></rects>
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<_>
<!-- root node -->
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      45 4 5 4 2.</_></rects>
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      17 15 47 1 2.</_></rects>
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<!-- root node -->
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    <!-- tree 0 -->
    <_>
      <!-- root node -->
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          <_>
            56 0 3 3 2.</_>
          <_>
            59 3 3 3 2.</_></rects>
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        <_>
          <!-- root node -->
          <feature>
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              <_>
                0 0 3 3 2.</_>
              <_>
                3 3 3 3 2.</_></rects>
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          <_>
            <!-- tree 2 -->
            <_>
              <!-- root node -->
              <feature>
                <rects>

```

```

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    <_>
      29 4 16 2 3.</_></rects>
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  <_>
    <!-- tree 3 -->
  <_>
    <!-- root node -->
    <feature>
      <rects>
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        <_>
          42 6 6 5 3.</_></rects>
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    <_>
      <!-- tree 4 -->
    <_>
      <!-- root node -->
      <feature>
        <rects>
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          <_>
            31 8 1 5 3.</_></rects>
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        <!-- tree 5 -->
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        <!-- root node -->
        <feature>
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            <_>
              55 13 8 3 2.</_></rects>
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<!-- tree 0 -->
<_>
<!-- root node -->
<feature>
<rects>
<_>
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<_>
6 6 2 7 2.</_></rects>
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<!-- root node -->
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    <_>
    0 12 30 2 3.</_></rects>
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<_>
<!-- root node -->
<feature>
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    <_>
    7 4 7 12 3.</_></rects>
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  <!-- tree 0 -->
  <_>
  <!-- root node -->
  <feature>
    <rects>
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      <_>
      44 7 1 7 2.</_></rects>
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```



```

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<!-- tree 1 -->
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    <_>
      56 3 2 3 2.</_></rects>
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  <right_val>6.6825848817825317e-001</right_val></_></_>
<_>
<!-- tree 2 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
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    <_>
      32 0 15 3 2.</_>
    <_>
      47 3 15 3 2.</_></rects>
  <tilted>0</tilted></feature>
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<!-- root node -->
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<_>
<!-- tree 4 -->

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```

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      <>
        31 10 1 3 3.</_></rects>
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  <!-- root node -->
  <feature>
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      <>
        29 3 8 4 3.</_></rects>
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    <right_val>6.4723730087280273e-001</right_val></_></_>
<>
<!-- tree 6 -->
<>
  <!-- root node -->
  <feature>
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      <>
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      <>
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    <!-- tree 0 -->

```

```

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      <_>
        59 9 3 6 2.</_></rects>
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  <!-- tree 1 -->
  <_>
    <!-- root node -->
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      <rects>
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        <_>
          6 7 1 3 2.</_></rects>
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      <right_val>-6.4777731895446777e-001</right_val></_></_>
<_>
  <!-- tree 2 -->
  <_>
    <!-- root node -->
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      <rects>
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        <_>
          0 0 6 2 2.</_>
        <_>
          6 2 6 2 2.</_></rects>
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      <right_val>7.1867972612380981e-001</right_val></_></_>
<_>
  <!-- tree 3 -->
  <_>
    <!-- root node -->
    <feature>
      <rects>

```

```

    <_>
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    <_>
      52 12 9 2 2.</_></rects>
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    <!-- tree 4 -->
  <_>
    <!-- root node -->
    <feature>
      <rects>
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        <_>
          10 5 1 8 2.</_></rects>
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    <next>-1</next></_>
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    <_>
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    <_>
      <!-- root node -->
      <feature>
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          <_>
            3 9 2 3 3.</_></rects>
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      <!-- tree 1 -->
    <_>
      <!-- root node -->
      <feature>
        <rects>

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```

    <_>
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    <_>
      56 12 2 4 2.</_></rects>
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    <!-- tree 2 -->
    <_>
      <!-- root node -->
      <feature>
        <rects>
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          <_>
            26 2 2 13 3.</_></rects>
          <tilted>0</tilted></feature>
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          <left_val>1.</left_val>
          <right_val>-9.1822808980941772e-001</right_val></_></_>
        <_>
          <!-- tree 3 -->
          <_>
            <!-- root node -->
            <feature>
              <rects>
                <_>
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                <_>
                  41 7 8 4 3.</_></rects>
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              <_>
                <!-- tree 0 -->
                <_>
                  <!-- root node -->
                  <feature>
                    <rects>

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```

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<_>
  1 3 57 2 2.</_></rects>
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<!-- root node -->
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<!-- tree 2 -->
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<!-- root node -->
<feature>
<rects>
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<_>
  54 3 2 10 3.</_></rects>
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<_>
  1 15 61 1 2.</_></rects>
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    <_>
      28 4 11 4 3.</_></rects>
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    <!-- tree 0 -->
    <_>
      <!-- root node -->
      <feature>
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          <_>
            22 3 41 2 2.</_></rects>
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        <left_val>-7.5719678401947021e-001</left_val>
        <right_val>7.5645631551742554e-001</right_val></_></_>
      <_>
        <!-- tree 1 -->
        <_>
          <!-- root node -->
          <feature>
            <rects>
              <_>
                41 6 6 8 -1.</_>
              <_>
                43 6 2 8 3.</_></rects>
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<!-- tree 2 -->
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<!-- root node -->
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    <_>
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    <_>
      57 9 7 5 2.</_></rects>
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John R. Hauser
2017 February 10

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04 ,-. /1

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*+*, $ *##$+## $#!#!*
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1.239 asm 5.0.4

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*/

/**

* Creates a new JSRInliner. *<i>Subclasses must not use this*

* constructor</i>. Instead, they must use the

* { @link #JSRInlinerAdapter(int, MethodVisitor, int, String, String, String, String[])}
 * version.

*

* @param mv

* the `MethodVisitor` to send the resulting inlined

* method code to (use `null` for none).

* @param access

* the method's access flags (see { @link Opcodes}). This

* parameter also indicates if the method is synthetic and/or

* deprecated.

* @param name

* the method's name.

* @param desc

* the method's descriptor (see { @link Type}).

* @param signature

* the method's signature. May be `null`.

* @param exceptions

* the internal names of the method's exception classes (see

```
*      { @link Type#getInternalName() getInternalName }). May be
*      <tt>null</tt>.
* @throws IllegalStateException
*      If a subclass calls this constructor.
*/
```

Found in path(s):

```
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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```

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*/

/**

* Creates a new { @link GeneratorAdapter}. *Subclasses must not use this
* constructor*. Instead, they must use the
* { @link #GeneratorAdapter(int, MethodVisitor, int, String, String)}
* version.
*
* @param mv
* the method visitor to which this adapter delegates calls.
* @param access
* the method's access flags (see { @link Opcodes}).
* @param name
* the method's name.
* @param desc
* the method's descriptor (see { @link Type Type}).
* @throws IllegalStateException
* If a subclass calls this constructor.
*/

Found in path(s):

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*/
/**
 * Constructs a new {@link Textifier}. Subclasses must not use this
 * constructor. Instead, they must use the {@link #Textifier(int)}
 * version.
 *
 * @throws IllegalStateException
 *         If a subclass calls this constructor.
 */

```

Found in path(s):

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/**

- * Constructs a new { @link ClassNode}. *<i>Subclasses must not use this constructor</i>. Instead, they must use the { @link #ClassNode(int)} version.*
- *
 * @throws IllegalStateException
 * If a subclass calls this constructor.

*/

Found in path(s):

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/ClassNode.java

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*/
/**
 * Constructs a new {@link LocalVariableAnnotationNode}. <i>Subclasses must
 * not use this constructor</i>. Instead, they must use the
 * {@link #LocalVariableAnnotationNode(int, TypePath, LabelNode[], LabelNode[], int[], String)}
 * version.
 *
 * @param typeRef
 *     a reference to the annotated type. See {@link TypeReference}.
 * @param typePath
 *     the path to the annotated type argument, wildcard bound, array
 *     element type, or static inner type within 'typeRef'. May be
 *     <tt>null</tt> if the annotation targets 'typeRef' as a whole.
 * @param start
 *     the first instructions corresponding to the continuous ranges
 *     that make the scope of this local variable (inclusive).
 * @param end
 *     the last instructions corresponding to the continuous ranges
 *     that make the scope of this local variable (exclusive). This
 *     array must have the same size as the 'start' array.
 * @param index
 *     the local variable's index in each range. This array must have
 *     the same size as the 'start' array.
 * @param desc
 *     the class descriptor of the annotation class.
 */

```

Found in path(s):

```

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/AnnotationWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SimpleVerifier.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/NameMapping.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Printer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/Shrinker.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/Method.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckAnnotationAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingSignatureAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingFieldAdapter.java

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Attribute.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SourceInterpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MethodInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceFieldVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SourceValue.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/AdviceAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/Remapper.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/BasicValue.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ByteVector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/AbstractInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Interpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/JumpInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/TableSwitchGenerator.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LabelNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ClassConstantsCollector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckSignatureAdapter.java
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/CodeSizeEvaluator.java
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassReader.java

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/VarInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingMethodAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Value.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/StaticInitMerger.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/AnnotationConstantsCollector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/AnnotationVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/signature/SignatureReader.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LdcInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LookupSwitchInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LineNumberNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/JarOptimizer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/LocalVariablesSorter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceAnnotationVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/Constant.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TypeAnnotationNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Handle.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TryCatchBlockNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ClassOptimizer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/ASMifier.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceClassVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TableSwitchInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Frame.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InvokeDynamicInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/AnalyzerException.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-

jar/org/objectweb/asm/tree/analysis/Subroutine.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/SerialVersionUIDAdder.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/InnerClassNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/ParameterNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/LocalVariableNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/Analyzer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/SmallSet.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/RemappingAnnotationAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/TypeInsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/TraceSignatureVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/InsnNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/MethodOptimizer.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/CheckFieldAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Frame.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/CheckMethodAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/SimpleRemapper.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/AnnotationNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Context.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/TraceMethodVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/MethodConstantsCollector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Handler.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/MethodNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnList.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/FieldConstantsCollector.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/analysis/BasicInterpreter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-

jar/org/objectweb/asm/signature/SignatureWriter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/commons/TryCatchBlockSorter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Item.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Edge.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassVisitor.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/tree/FrameNode.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/optimizer/ConstantPool.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/Opcodes.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/util/CheckClassAdapter.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
jar/org/objectweb/asm/signature/SignatureVisitor.java
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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Textifiable.java
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/ASMifiable.java
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```

```
*/
```

```
/**
```

```
 * Creates a new {@link AnalyzerAdapter}. <i>Subclasses must not use this
```

```
 * constructor</i>. Instead, they must use the
```

```
 * {@link #AnalyzerAdapter(int, String, int, String, String, MethodVisitor)}
```

```
 * version.
```

```
*
```

```
 * @param owner
```

```
 * the owner's class name.
```

```
 * @param access
```

```
 * the method's access flags (see {@link Opcodes}).
```

```
 * @param name
```

```
 * the method's name.
```

```
 * @param desc
```

```
 * the method's descriptor (see {@link Type Type}).
```

```
 * @param mv
```

```
*      the method visitor to which this adapter delegates calls. May
*      be <tt>null</tt>.
* @throws IllegalStateException
*      If a subclass calls this constructor.
*/
```

Found in path(s):

```
* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-
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- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-frames.properties
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-resize.properties
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-signatures.properties
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink.properties
- * /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-writer.properties

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* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/TypePath.java

* /opt/cola/permits/1135863767_1613617914.89/0/asm-5-0-4-sources-6-jar/org/objectweb/asm/TypeReference.java

1.240 spring-security-config 5.3.4.RELEASE

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* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/debug/SecurityDebugBeanFactoryPostProcessor.java

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- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/X509Dsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/session/SessionConcurrencyDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/OAuth2ClientBeanDefinitionParser.java
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/server/ServerHttpSecurity.java
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/headers/FrameOptionsDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/headers/ReferrerPolicyDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/headers/XssProtectionConfigDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/PortMapperDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/FormLoginDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/AuthorizeRequestsDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/CsrfDsl.kt
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- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/AuthenticationConfigBuilder.java
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/RequestCacheDsl.kt
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- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/oauth2/login/RedirectionEndpointDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/web/servlet/oauth2/login/UserInfoEndpointDsl.kt
- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-

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* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-
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* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/websocket/WebSocketMessageBrokerSecurityBeanDefinitionParser.java
* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecuritySelector.java
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* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/annotation/web/configuration/WebSecurityConfigurerAdapter.java
* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/annotation/web/configuration/EnableWebSecurity.java

* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/annotation/web/configurers/ExpressionUrlAuthorizationConfigurer.java
* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/FormLoginBeanDefinitionParser.java
* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/method/GlobalMethodSecurityBeanDefinitionParser.java
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* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/authentication/AuthenticationManagerBeanDefinitionParser.java
* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/CorsBeanDefinitionParser.java
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* /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/HandlerMappingIntrospectorFactoryBean.java

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- * /opt/ws_local/PERMITS_SQL/1081949386_1599626452.65/0/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/annotation/web/servlet/configuration/WebMvcSecurityConfiguration.java
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Bnd-LastModified: 1563545580901

Build-Jdk: 1.8.0_202

Built-By: jenkins-slave

Bundle-Description: A set of Java modules for management and monitoring,
common to several Terracotta products

Bundle-License: <http://www.apache.org/licenses/LICENSE-2.0.txt>

Bundle-ManifestVersion: 2

Bundle-Name: Terracotta Management :: Sequence Generator

Bundle-SymbolicName: org.terracotta.management.sequence-generator

Bundle-Version: 5.7.3

Created-By: Apache Maven Bundle Plugin

Export-Package: org.terracotta.management.sequence;version="5.7.3",org.t
erracotta.management.sequence.perf;version="5.7.3"

Main-Class: org.terracotta.management.sequence.perf.PerfTest

Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.8))"

Tool: Bnd-2.4.1.201501161923

Found in path(s):

* /opt/cola/permits/1258059180_1643027223.49/0/sequence-generator-5-7-3-jar/META-INF/MANIFEST.MF

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Found in path(s):

* /opt/cola/permits/1258059180_1643027223.49/0/sequence-generator-5-7-3-jar/META-

INF/maven/org.terracotta.management/sequence-generator/pom.xml

1.242 runc 1.0.0-rc9

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1.248 shared-mime-info 1.6

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1.249 docker-cli v19.03.5

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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

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1.251 libjpeg 8d

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

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* <https://github.com/eclipse-ee4j/jaf>

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1.255 jackson-dataformat-yaml 2.11.2

1.255.1 Available under license :

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1.257 python-requests 2.22.0

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1.259 nettle 3.5.1+really3.5.1-2ubuntu0.2

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1.260 statistics 2.1

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1.261 python-pip 22.0.4

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A. HISTORY OF THE SOFTWARE

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

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

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

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Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes

1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
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2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
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2.5	2.4	2006	PSF	yes
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2.5.3	2.5.2	2008	PSF	yes
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2.6.5	2.6.4	2010	PSF	yes
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This package contains a modified version of ca-bundle.crt:

ca-bundle.crt -- Bundle of CA Root Certificates

Certificate data from Mozilla as of: Thu Nov 3 19:04:19 2011#

This is a bundle of X.509 certificates of public Certificate Authorities (CA). These were automatically extracted from Mozilla's root certificates file (certdata.txt). This file can be found in the mozilla source tree:

<http://mxr.mozilla.org/mozilla/source/security/nss/lib/ckfw/builtins/certdata.txt?raw=1#>

It contains the certificates in PEM format and therefore can be directly used with curl / libcurl / php_curl, or with an Apache+mod_ssl webserver for SSL client authentication.

Just configure this file as the SSLCACertificateFile.#

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@(#) \$RCSfile: certdata.txt,v \$ \$Revision: 1.80 \$ \$Date: 2011/11/03 15:11:58 \$
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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

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

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

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes

2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
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2.4.3	2.4.2	2006	PSF	yes
2.4.4	2.4.3	2006	PSF	yes
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2.5.1	2.5	2007	PSF	yes
2.5.2	2.5.1	2008	PSF	yes
2.5.3	2.5.2	2008	PSF	yes
2.6	2.5	2008	PSF	yes
2.6.1	2.6	2008	PSF	yes
2.6.2	2.6.1	2009	PSF	yes
2.6.3	2.6.2	2009	PSF	yes
2.6.4	2.6.3	2009	PSF	yes
2.6.5	2.6.4	2010	PSF	yes
3.0	2.6	2008	PSF	yes
3.0.1	3.0	2009	PSF	yes
3.1	3.0.1	2009	PSF	yes
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2.1.1	2.1+2.0.1	2001	PSF	yes
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1.263 docker-containerd 1.3.2

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.267 jansi-osx 1.8

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Found in path(s):

* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-

```
jar/org/fusesource/jansi/internal/Kernel32.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
jar/org/fusesource/jansi/internal/WindowsSupport.java
* /opt/cola/permits/1257860178_1643019491.32/0/jansi-osx-1-8-sources-
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1.268 apr 1.6.5

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From dso/aix/dso.c:

- * Based on libdl (dlfcn.c/dlfcn.h) which is
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From strings/apr_strnatcmp.c, include/apr_strings.h:

strnatcmp.c -- Perform 'natural order' comparisons of strings in C.
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From strings/apr_snprintf.c:

- *
- * cvt - IEEE floating point formatting routines.
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1.269 p11-kit 0.23.20-1ubuntu0.1

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1.270 lua 5.1.4

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1.271 pcre 8.42

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1.272 swagger-core 2.1.9

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1.273 openssl 1.1.1d

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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/DefaultExecutionStrategy.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-

jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Event.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/StringResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceNameParser.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/output/InfoOutput.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/ClassUtils.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBTable.java
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* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/filesystem/FileSystemResource.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/exception/FlywaySqlException.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
* /opt/cola/permits/1100808595_1602883955.19/0/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/package-info.java

1.275 libestr 0.1.9

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Version 2.1, February 1999

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1.276 byte-buddy 1.10.14

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1.277 libpcap 1.7.4

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1.278 libusrctp 1.0

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1.279 nginx 1.18.0

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1.280 @tensorflow/tfjs 3.11.0

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1.281 golang 1.8

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# Please keep the list sorted.

Aamir Khan <syst3m.w0rm@gmail.com>
Aaron France <aaron.l.france@gmail.com>
Aaron Jacobs <jacobsa@google.com>
```

Aaron Kemp <kemp.aaron@gmail.com>
Aaron Torres <tcboox@gmail.com>
Aaron Zinman <aaron@azinman.com>
Abe Haskins <abeisgreat@abeisgreat.com>
Abhinav Gupta <abhinav.g90@gmail.com>
Adam Langley <agl@golang.org>
Adrian Nos <nos.adrian@gmail.com>
Adrian O'Grady <elpollouk@gmail.com>
Adrien Bustany <adrien-xx-google@bustany.org>
Acio Jnior <aeciodantasjunior@gmail.com>
Ahmed Waheed Moanes <oneofone@gmail.com>
Ahmy Yulrizka <yulrizka@gmail.com>
Aiden Scandella <ai@uber.com>
Ainar Garipov <gugl.zadolbal@gmail.com>
Akihiro Suda <suda.kyoto@gmail.com>
Akshat Kumar <seed@mail.nanosouffle.net>
Alan Donovan <adonovan@google.com>
Alan Shreve <alan@inconshreveable.com>
Albert Nigmatzianov <albertnigma@gmail.com>
Albert Strasheim <fullung@gmail.com>
Albert Yu <yukinying@gmail.com>
Alberto Bertogli <albertito@blitiri.com.ar>
Alberto Donizetti <alb.donizetti@gmail.com>
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>
Aleksandar Dezelin <dezelin@gmail.com>
Alessandro Arzilli <alessandro.arzilli@gmail.com>
Alessandro Baffa <alessandro.baffa@gmail.com>
Alex A Skinner <alex@lx.lc>
Alex Brainman <alex.brainman@gmail.com>
Alex Bramley <abramley@google.com>
Alex Browne <stephenalexbrowne@gmail.com>
Alex Carol <alex.carol.c@gmail.com>
Alex Jin <toalexjin@gmail.com>
Alex Plugaru <alex@plugaru.org> <alexandru.plugaru@gmail.com>
Alex Schroeder <alex@gnu.org>
Alex Sergeev <abc@alexsergeev.com>
Alex Vaghin <crhyme@google.com>
Alexander Demakin <alexander.demakin@gmail.com>
Alexander Dring <email@alex.d.ch>
Alexander Larsson <alexander.larsson@gmail.com>
Alexander Menzhinsky <amenzhinsky@gmail.com>
Alexander Morozov <lk4d4math@gmail.com>
Alexander Neumann <alexander@bumper.de>
Alexander Orlov <alexander.orlov@loxal.net>
Alexander Reece <awreece@gmail.com>
Alexander Surma <surma@surmair.de>
Alexander Zhavnerchik <alex.vizor@gmail.com>
Alexander Zolotov <goldifit@gmail.com>

Alexandre Cesaro <alexandre.cesaro@gmail.com>
Alexandre Fiori <fiorix@gmail.com>
Alexandre Normand <alexandre.normand@gmail.com>
Alexandru Mooi <brtznr@gmail.com>
Alexei Sholik <alcosholik@gmail.com>
Alexey Borzenkov <snaury@gmail.com>
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>
Alexis Imperial-Legrand <ail@google.com>
Aliaksandr Valialkin <valyala@gmail.com>
Alif Rachmawadi <subosito@gmail.com>
Allan Simon <allan.simon@supinfo.com>
Alok Menghrajani <alok.menghrajani@gmail.com>
Amir Mohammad Saied <amir@gluegadget.com>
Amrut Joshi <amrut.joshi@gmail.com>
Andre Nathan <andrenth@gmail.com>
Andrea Spadaccini <spadaccio@google.com>
Andreas Auernhammer <aead@mail.de>
Andreas Jellinghaus <andreas@ionisiert.de> <anj@google.com>
Andreas Litt <andreas.litt@gmail.com>
Andrei Korzhevskii <a.korzhevskiy@gmail.com>
Andrei Vieru <euvieru@gmail.com>
Andres Erbsen <andreser@google.com>
Andrew Austin <andrewacht@gmail.com>
Andrew Balholm <andybalholm@gmail.com>
Andrew Bonventre <andybons@chromium.org>
Andrew Bursavich <abursavich@gmail.com>
Andrew Ekstedt <andrew.ekstedt@gmail.com>
Andrew Etter <andrew.etter@gmail.com>
Andrew Gerrand <adg@golang.org>
Andrew Harding <andrew@spacemonkey.com>
Andrew Lutomirski <andy@luto.us>
Andrew Pilloud <andrewpilloud@igneoussystem.com>
Andrew Pogrebnoy <absourd.noise@gmail.com>
Andrew Pritchard <awpritchard@gmail.com>
Andrew Radev <andrey.radev@gmail.com>
Andrew Skiba <skibaa@gmail.com>
Andrew Szeto <andrew@jabagawee.com>
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>
Andrew Wilkins <axwalk@gmail.com>
Andrew Williams <williams.andrew@gmail.com>
Andrey Mirtchovski <mirtchovski@gmail.com>
Andrey Petrov <andrey.petrov@shazow.net>
Andriy Lytvynov <lytvynov.a.v@gmail.com>
Andy Balholm <andy@balholm.com>
Andy Davis <andy@bigandian.com>
Andy Finkenstadt <afinkenstadt@zynga.com>
Andy Maloney <asmaloney@gmail.com>
Anfernee Yongkun Gui <anfernee.gui@gmail.com>

Angelo Bulfone <mbulfone@gmail.com>
Anh Hai Trinh <anh.hai.trinh@gmail.com>
Anmol Sethi <anmol@aubble.com>
Anschel Schaffer-Cohen <anschelsc@gmail.com>
Anthony Canino <anthony.canino1@gmail.com>
Anthony Eufemio <anthony.eufemio@gmail.com>
Anthony Martin <ality@pbrane.org>
Anthony Starks <ajstarks@gmail.com>
Anthony Woods <awoods@raintank.io>
Antonio Bibiano <antbbn@gmail.com>
Antonio Murdaca <runcom@redhat.com>
Apisak Darakananda <pongad@gmail.com>
Aram Hvrneanu <aram@mgk.ro>
Areski Belaid <areski@gmail.com>
Arkadi Pyuro <arkadi@google.com>
Arlo Breault <arlolra@gmail.com>
Arnaud Ysmal <arnaud.ysmal@gmail.com>
Arne Hormann <arnehormann@gmail.com>
Arnout Engelen <arnout@bzbt.net>
Aron Nopanen <aron.nopanen@gmail.com>
Artyom Pervukhin <artyom.pervukhin@gmail.com>
Arvindh Rajesh Tamilmani <art@a-30.net>
Asim Shankar <asimshankar@gmail.com>
Atin Malaviya <amalaviy@akamai.com>
Ato Araki <ato.araki@gmail.com>
Audrey Lim <audreylh@gmail.com>
Augusto Roman <aroman@gmail.com>
Aulus Egnatius Varialus <varialus@gmail.com>
Austin Clements <austin@google.com> <aclements@csail.mit.edu>
awaw fumin <awawfumin@gmail.com>
Ayanamist Yang <ayanamist@gmail.com>
Aymerick Jhanne <aymerick@jehanne.org>
Baiju Muthukadan <baiju.m.mail@gmail.com>
Balazs Lecz <leczb@google.com>
Ben Burkert <ben@benburkert.com>
Ben Eitzen <eitzenb@golang.org>
Ben Fried <ben.fried@gmail.com>
Ben Lubar <ben.lubar@gmail.com>
Ben Lynn <benlynn@gmail.com>
Ben Olive <sionide21@gmail.com>
Benjamin Black <b@b3k.us>
Benjamin Prosnitz <bprosnitz@google.com>
Benjamin Wester <bwester@squareup.com>
Benny Siegert <bsiegert@gmail.com>
Benoit Sigoure <tsunanet@gmail.com>
Berengar Lehr <Berengar.Lehr@gmx.de>
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>
Bill O'Farrell <billo@ca.ibm.com>

Bill Thiede <couchmoney@gmail.com>
Billie Harold Cleek <bhcleek@gmail.com>
Billy Lynch <wlynch@google.com>
Bjorn Tillenius <bjorn@tillenius.me>
Bjorn Tipling <bjorn.tipling@gmail.com>
Blake Gentry <blakesgentry@gmail.com>
Blake Mizerany <blake.mizerany@gmail.com>
Blixt <me@blixt.nyc>
Bobby Powers <bobbypowers@gmail.com>
Boris Nagaev <nagaev@google.com>
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>
Brad Garcia <bgarcia@golang.org>
Braden Bassingthwaite <bbassingthwaite@vendasta.com>
Brady Catherman <brady@gmail.com>
Brady Sullivan <brady@bsull.com>
Brandon Gilmore <varz@google.com>
Brendan Daniel Tracey <tracey.brendan@gmail.com>
Brendan O'Dea <bod@golang.org>
Brett Cannon <bcannon@gmail.com>
Brian Dellisanti <briandellisanti@gmail.com>
Brian G. Merrell <bgmerrell@gmail.com>
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>
Brian Kennedy <btkenedy@gmail.com>
Brian Ketelsen <bketelsen@gmail.com>
Brian Slesinsky <skybrian@google.com>
Brian Smith <ohohvi@gmail.com>
Bryan Alexander <Kozical@msn.com>
Bryan C. Mills <bcmills@google.com>
Bryan Chan <bryan.chan@ca.ibm.com>
Bryan Ford <brynosaurus@gmail.com>
Caine Tighe <arctanofyourface@gmail.com>
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>
Caleb Spare <cespare@gmail.com>
Carl Chatfield <carlchatfield@gmail.com>
Carl Jackson <carl@stripe.com>
Carl Johnson <me@carlmjohnson.net>
Carl Mastrangelo <notcarl@google.com>
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>
Carlos Castillo <cookieo9@gmail.com>
Carlos Cirello <uldericofilho@gmail.com>
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>
Cary Hull <chull@google.com>
Case Nelson <case.nelson@gmail.com>
Casey Marshall <casey.marshall@gmail.com>
Catalin Nicutar <cnicutar@google.com>
Catalin Patulea <catalinp@google.com>
Cedric Staub <cs@squareup.com>
Cezar S Espinola <cezarsa@gmail.com>

ChaiShushan <chaishushan@gmail.com>
Charles L. Dorian <cldorian@gmail.com>
Charles Lee <zombie.fml@gmail.com>
Charles Weill <weill@google.com>
Cherry Zhang <cherryyz@google.com>
Chris Broadfoot <cbro@golang.org>
Chris Dollin <ehog.hedge@gmail.com>
Chris Farmiloe <chrisfarms@gmail.com>
Chris Hines <chris.cs.guy@gmail.com>
Chris Howey <howeyc@gmail.com>
Chris Hundt <hundt@google.com>
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>
Chris Kastorff <encryptio@gmail.com>
Chris Lennert <calennert@gmail.com>
Chris Manghane <cmang@golang.org>
Chris McGee <sirnewton_01@yahoo.ca> <newton688@gmail.com>
Chris Stockton <chrisstocktonaz@gmail.com>
Chris Zou <chriszou@ca.ibm.com>
Christian Couder <chriscool@tuxfamily.org>
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>
Christine Hansmann <chhansmann@gmail.com>
Christoffer Buchholz <christoffer.buchholz@gmail.com>
Christoph Hack <christoph@tux21b.org>
Christopher Cahoon <chris.cahoon@gmail.com>
Christopher Guiney <chris@guiney.net>
Christopher Nelson <nadiasvertex@gmail.com>
Christopher Nielsen <m4dh4tt3r@gmail.com>
Christopher Redden <christopher.redden@gmail.com>
Christopher Swenson <cswenson@google.com>
Christopher Wedgwood <cw@f00f.org>
Christy Perez <christy@linux.vnet.ibm.com>
CL Sung <clsung@gmail.com> <cl_sung@htc.com>
Clement Skau <clementska@gmail.com>
Colby Ranger <cranger@google.com>
Colin Cross <ccross@android.com>
Colin Edwards <colin@recursivepenguin.com>
Colin Kennedy <moshen.colin@gmail.com>
Conrad Irwin <conrad.irwin@gmail.com>
Conrad Meyer <cemeyer@cs.washington.edu>
Corey Thomasson <cthom.lists@gmail.com>
Cosmos Nicolaou <cnicolaou@google.com>
Cristian Staretu <unclejacksons@gmail.com>
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>
Cyrill Schumacher <cyrill@schumacher.fm>
Damian Gryski <dgryski@gmail.com>
Damien Neil <dneil@google.com>
Dan Caddigan <goldcaddy77@gmail.com>
Dan Callahan <dan.callahan@gmail.com>

Dan Harrington <harringtond@google.com>
Dan Jacques <dnj@google.com>
Dan Peterson <dpiddy@gmail.com>
Dan Pupius <dan@medium.com>
Dan Sinclair <dan.sinclair@gmail.com>
Daniel Fleischman <danielfleischman@gmail.com>
Daniel Johansson <dajo2002@gmail.com>
Daniel Kerwin <d.kerwin@gini.net>
Daniel Krech <eikeon@eikeon.com>
Daniel Lidn <daniel.liden.87@gmail.com>
Daniel Mart <mvdan@mvdan.cc>
Daniel Morsing <daniel.morsing@gmail.com>
Daniel Nadasi <dnadasi@google.com>
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>
Daniel Skinner <daniel@dasa.cc>
Daniel Speichert <daniel@speichert.pl>
Daniel Theophanes <kardianos@gmail.com>
Daria Kolistratova <daria.kolistratova@intel.com>
Darren Elwood <darren@textnode.com>
Datong Sun <dndx@idndx.com>
Dave Borowitz <dborowitz@google.com>
Dave Bort <dbort@golang.org>
Dave Cheney <dave@cheney.net>
Dave Day <djd@golang.org>
Dave Grijalva <dgrijalva@ngmoco.com>
David Anderson <danderson@google.com>
David Barnett <dbarnett@google.com>
David Benjamin <davidben@google.com>
David Brophy <dave@brophy.uk>
David Brgin <676c7473@gmail.com>
David Calavera <david.calavera@gmail.com>
David Chase <drchase@google.com>
David Covert <davidhcovert@gmail.com>
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>
David du Colombier <0intro@gmail.com>
David Forsythe <dforsythe@gmail.com>
David G. Andersen <dave.andersen@gmail.com>
David Glasser <glasser@meteor.com>
David Howden <dhowden@gmail.com>
David Hubbard <dsp@google.com>
David Jakob Fritz <david.jakob.fritz@gmail.com>
David Lazar <lazard@golang.org>
David Leon Gil <coruus@gmail.com>
David McLeish <davemc@google.com>
David Presotto <presotto@gmail.com>
David R. Jenni <david.r.jenni@gmail.com>
David Sansome <me@davidsansome.com>
David Stainton <dstainton415@gmail.com>

David Symonds <dsymonds@golang.org>
David Thomas <davidthomas426@gmail.com>
David Titarenco <david.titarenco@gmail.com>
Davies Liu <davies.liu@gmail.com>
Dean Prichard <dean.prichard@gmail.com>
Deepak Jois <deepak.jois@gmail.com>
Denis Bernard <db047h@gmail.com>
Denis Brandolini <denis.brandolini@gmail.com>
Denis Nagorny <denis.nagorny@intel.com>
Denys Honsiorovskiy <honsiorovskiy@gmail.com>
Derek Buitenhuis <derek.buitenhuis@gmail.com>
Derek Che <drc@yahoo-inc.com>
Derek Parker <parkerderek86@gmail.com>
Derek Shockey <derek.shockey@gmail.com>
Devon H. O'Dell <devon.odell@gmail.com>
Dhaivat Pandit <dhaivatpandit@gmail.com>
Dhananjay Nakrani <dhananjayn@google.com>
Dhiru Kholia <dhiru.kholia@gmail.com>
Didier Spezia <didier.06@gmail.com>
Dimitri Tcaciuc <dtcaciuc@gmail.com>
Dirk Gadsden <dirk@esherido.com>
Diwaker Gupta <diwakergupta@gmail.com>
Dmitri Popov <operator@cv.dp-net.com>
Dmitri Shuralyov <shurcool@gmail.com>
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>
Dmitriy Vyukov <dvyukov@google.com>
Dmitry Chestnykh <dchest@gmail.com>
Dmitry Savintsev <dsavints@gmail.com>
Dmitry Yakunin <nonamezeil@gmail.com>
Dominik Honnef <dominik.honnef@gmail.com>
Dominik Vogt <vogt@linux.vnet.ibm.com>
Donald Huang <don.hcd@gmail.com>
Donovan Hide <donovanhide@gmail.com>
Doug Anderson <douga@google.com>
Drew Hintz <adhintz@google.com>
Duncan Holm <mail@frou.org>
Dustin Carlino <dcarlino@google.com>
Dustin Herbison <djherbis@gmail.com>
Dustin Long <dustmop@gmail.com>
Dustin Sallings <dsallings@gmail.com>
Dustin Shields-Cloues <dcloues@gmail.com>
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>
Eden Li <eden.li@gmail.com>
Edward Muller <edwardam@interlix.com>
Egon Elbre <egonelbre@gmail.com>
Ehren Kret <ehren.kret@gmail.com>
Eivind Uggedal <eivind@uggedal.com>

Elias Naur <elias.naur@gmail.com>
Elliot Morrison-Reed <elliottmr@gmail.com>
Emil Hessman <c.emil.hessman@gmail.com> <emil@hessman.se>
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>
Eoghan Sherry <ejsherry@gmail.com>
Eric Clark <zerohp@gmail.com>
Eric Engestrom <eric@engestrom.ch>
Eric Garrido <ekg@google.com>
Eric Koleda <ekoleda+devrel@google.com>
Eric Lagergren <ericscottlagergren@gmail.com>
Eric Milliken <emilliken@gmail.com>
Eric Roshan-Eisner <eric.d.eisner@gmail.com>
Erik Aigner <aigner.erik@gmail.com>
Erik Dubbelboer <erik@dubbelboer.com>
Erik St. Martin <alakriti@gmail.com>
Erik Staab <estaab@google.com>
Erik Westrup <erik.westrup@gmail.com>
Ernest Chiang <ernest_chiang@htc.com>
Esko Luontola <esko.luontola@gmail.com>
Ethan Burns <eaburns@google.com>
Ethan Miller <eamiller@us.ibm.com>
Euan Kemp <euank@euank.com>
Evan Broder <evan@stripe.com>
Evan Brown <evanbrown@google.com>
Evan Kroske <evankroske@google.com>
Evan Martin <evan.martin@gmail.com>
Evan Phoenix <evan@phx.io>
Evan Shaw <chickencha@gmail.com>
Ewan Chou <coocood@gmail.com>
Fabian Wickborn <fabian@wickborn.net>
Fabrizio Milo <mistobaan@gmail.com>
Faiyaz Ahmed <ahmedf@vmware.com>
Fan Hongjian <fan.howard@gmail.com>
Fatih Arslan <fatih@arslan.io>
Fazlul Shahriar <fshahriar@gmail.com>
Federico Simoncelli <fsimonce@redhat.com>
Fedor Indutny <fedor@indutny.com>
Felix Geisendrfer <haimuiba@gmail.com>
Filippo Valsorda <hi@filippo.io>
Firmansyah Adiputra <frm.adiputra@gmail.com>
Florian Uekermann <florian@uekermann-online.de> <fl@uekermann-online.de>
Florian Weimer <fw@deneb.enyo.de>
Florin Patan <florinpatan@gmail.com>
Folke Behrens <folke@google.com>
Ford Hurley <ford.hurley@gmail.com>
Francesc Campoy <campoy@golang.org>
Francisco Claude <fclaud@recoded.cl>
Francisco Souza <franciscossouza@gmail.com>

Frederick Kelly Mayle III <frederickmayle@gmail.com>
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>
Frits van Bommel <fvbommel@gmail.com>
Fumitoshi Ukai <ukai@google.com>
Gaal Yahas <gaal@google.com>
Gabriel Aszalos <gabriel.aszalos@gmail.com>
Gabriel Russell <gabriel.russell@gmail.com>
Gareth Paul Jones <gpj@foursquare.com>
Garrick Evans <garrick@google.com>
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>
Gary Elliott <garyelliott@google.com>
Gaurish Sharma <contact@aurishsharma.com>
Gautham Thambidorai <gautham.dorai@gmail.com>
Geert-Johan Riemer <gjr19912@gmail.com>
Geoffroy Lorieux <lorieux.g@gmail.com>
Georg Reinke <guelfey@gmail.com>
George Shammass <george@shamm.as> <georgyo@gmail.com>
Gerasimos Dimitriadis <gedimitr@gmail.com>
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>
Giles Lean <giles.lean@pobox.com>
Giovanni Bajo <rasky@develer.com>
Giulio Iotti <dullgiulio@gmail.com>
Gleb Stepanov <glebstepanov1992@gmail.com>
Glenn Brown <glennb@google.com>
Glenn Lewis <gmlewis@google.com>
Gordon Klaus <gordon.klaus@gmail.com>
Graham King <graham4king@gmail.com>
Graham Miller <graham.miller@gmail.com>
Greg Ward <greg@gerg.ca>
Guillaume J. Charmes <guillaume@charmest.net>
Guobiao Mei <meiguobiao@gmail.com>
Gustav Paul <gustav.paul@gmail.com>
Gustavo Franco <gustavorfranco@gmail.com>
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>
Gwenael Treguier <gwenn.kahz@gmail.com>
Gyu-Ho Lee <gyuhox@gmail.com>
H. brahim Gngr <igungor@gmail.com>
Hajime Hoshi <hajimehoshi@gmail.com>
Hallgrimur Gunnarsson <halg@google.com>
Han-Wen Nienhuys <hanwen@google.com>
Hari haran <hariharan.uno@gmail.com>
Hariharan Srinath <srinathh@gmail.com>
Harley Laue <losinggeneration@gmail.com>
Harry Moreno <morenoh149@gmail.com>
Harshavardhana <hrshvardhana@gmail.com>
Hvard Haugen <havard.haugen@gmail.com>
Hector Chu <hectorchu@gmail.com>

Hector Martin Cantero <hector@marcansoft.com>
Henning Schmiedehausen <henning@schmiedehausen.org>
Henrik Edwards <henrik.edwards@gmail.com>
Henrik Hodne <henrik@hodne.io>
Herbert Georg Fischer <herbert.fischer@gmail.com>
Hironao OTSUBO <motemen@gmail.com>
Hiroshi Ioka <hirochachacha@gmail.com>
Hitoshi Mitake <mitake.hitoshi@gmail.com>
Holden Huang <ttyh061@gmail.com>
Hong Ruiqi <hongruiqi@gmail.com>
Hossein Sheikh Attar <hattar@google.com>
Hsin-Ho Yeh <yhh92u@gmail.com>
Hu Keping <hukeping@huawei.com>
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>
Ian Gudger <ian@loosescre.ws>
Ian Lance Taylor <iant@golang.org>
Icarus Sparry <golang@icarus.freeuk.com>
Idora Shinatose <idora.shinatose@gmail.com>
Igor Bernstein <igorbernstein@google.com>
Igor Dolzhevikov <bluesriverz@gmail.com>
Ilya Tocar <ilya.tocar@intel.com>
INADA Naoki <songofacandy@gmail.com>
Ingo Krabbe <ikrabbe.ask@gmail.com>
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>
Irieda Noboru <irieda@gmail.com>
Isaac Wagner <ibw@isaacwagner.me>
Ivan Babrou <ivan@cloudflare.com>
Ivan Krasin <krasin@golang.org>
Ivan Ukhov <ivan.ukhov@gmail.com>
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>
Jack Lindamood <jlindamo@justin.tv>
Jacob Baskin <jbaskin@google.com>
Jacob H. Haven <jacob@cloudflare.com>
Jacob Hoffman-Andrews <github@hoffman-andrews.com>
Jae Kwon <jae@tendermint.com>
Jakob Borg <jakob@nym.se>
Jakub ajka <jcajka@redhat.com>
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>
James Aguilar <jaguilar@google.com>
James Bardin <j.bardin@gmail.com>
James Chacon <jchacon@google.com>
James Clarke <jrtc27@jrtc27.com>
James David Chalfant <james.chalfant@gmail.com>
James Fysh <james.fysh@gmail.com>
James Gray <james@james4k.com>
James Meneghello <rawrz0r@gmail.com>
James P. Cooper <jamespcooper@gmail.com>
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>

James Schofield <james@shoeboxapp.com>
James Sweet <james.sweet88@googlemail.com>
James Toy <nil@opensesame.st>
James Tucker <raggi@google.com>
James Whitehead <jnwhiteh@gmail.com>
Jamie Beverly <jamie.r.beverly@gmail.com>
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>
Jamie Turner <jamwt@dropbox.com>
Jamie Wilkinson <jaq@spacepants.org>
Jamil Djadala <djadala@gmail.com>
Jan H. Hosang <jan.hosang@gmail.com>
Jan Kratochvil <jan.kratochvil@redhat.com>
Jan Mercl <0xjnml@gmail.com>
Jan Mercl <befelemepeseveze@gmail.com>
Jan Newmarch <jan.newmarch@gmail.com>
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>
Jaroslavas Poepko <jp@webmaster.ms>
Jason Barnett <jason.w.barnett@gmail.com>
Jason Buberel <jbuberel@google.com>
Jason Del Ponte <delpontej@gmail.com>
Jason Hall <jasonhall@google.com>
Jason Smale <jsmale@zendesk.com>
Jason Travis <infomaniac7@gmail.com>
Jay Weisskopf <jay@jayschwa.net>
Jean-Marc Eurin <jmeurin@google.com>
Jean-Nicolas Moal <jn.moal@gmail.com>
Jed Denlea <jed@fastly.com>
Jeff Craig <jeffcraig@google.com>
Jeff Hodges <jeff@somethingsimilar.com>
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>
Jeff Sickel <jas@corpus-callosum.com>
Jeff Wendling <jeff@spacemonkey.com>
Jens Frederich <jfrederich@gmail.com>
Jeremiah Harmsen <jeremiah@google.com>
Jeremy Jackins <jeremyjackins@gmail.com>
Jeremy Schlatter <jeremy.schlatter@gmail.com>
Jeroen Bobbeldijk <jerbob92@gmail.com>
Jess Frazelle <me@jessfraz.com>
Jesse Szwedko <jesse.szwedko@gmail.com>
Jihyun Yu <yjh0502@gmail.com>
Jim Cote <jfcote87@gmail.com>
Jim Kingdon <jim@bolt.me>
Jim McGrath <jimmc2@gmail.com>
Jimmy Zelinskie <jimmyzelinskie@gmail.com>
Jingcheng Zhang <diogin@gmail.com>
Jingguo Yao <yaojingguo@gmail.com>
Jiong Du <londevil@gmail.com>

Jirka Dank <dnk@mail.muni.cz>
Joakim Sernbrant <serbaut@gmail.com>
Joe Farrell <joe2farrell@gmail.com>
Joe Harrison <joehazzers@gmail.com>
Joe Henke <joed.henke@gmail.com>
Joe Poirier <jdpoirier@gmail.com>
Joe Shaw <joe@joeshaw.org>
Joe Sylve <joe.sylve@gmail.com>
Joe Tsai <joetsai@digital-static.net>
Joel Sing <jsing@google.com>
Joel Stemmer <stemmertech@gmail.com>
Johan Euphrosine <proppy@google.com>
Johan Sageryd <j@1616.se>
John Asmuth <jasmuth@gmail.com>
John Beisley <huin@google.com>
John C Barstow <jbowtie@amathaine.com>
John DeNero <denero@google.com>
John Dethridge <jcd@golang.org>
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>
John Howard Palevich <jack.palevich@gmail.com>
John Jeffery <jjeffery@sp.com.au>
John Jenkins <twodopeshaggy@gmail.com>
John Newlin <jnewlin@google.com>
John Potocny <johnp@vividcortex.com>
John Schnake <schnake.john@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
Jon Chen <jchen@justin.tv>
Jonathan Allie <jonallie@google.com>
Jonathan Amsterdam <jba@google.com>
Jonathan Boulle <jonathanboulle@gmail.com>
Jonathan Feinberg <feinberg@google.com>
Jonathan Gold <jgold.bg@gmail.com>
Jonathan Hseu <jhseu@google.com>
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>
Jonathan Nieder <jrn@google.com>
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>
Jonathan Rudenberg <jonathan@titanous.com>
Jonathan Wills <runningwild@gmail.com>
Jongmin Kim <atomaths@gmail.com>
Joonas Kuorilehto <joneskoo@derbian.fi>
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>
Jordan Lewis <jordanthelewis@gmail.com>
Jos Visser <josv@google.com>
Jose Luis Vazquez Gonzalez <josvazg@gmail.com>
Joseph Bonneau <jcb@google.com>
Joseph Holsten <joseph@josephholsten.com>
Josh Bleecher Snyder <josharian@gmail.com>

Josh Chorlton <jchorlton@gmail.com>
Josh Goebel <dreamer3@gmail.com>
Josh Hoak <jhoak@google.com>
Josh Holland <jrh@joshh.co.uk>
Joshua Boelter <joshua.boelter@intel.com>
Joshua Chase <jcjosuachase@gmail.com>
Jostein Stuhauug <js@solidsystem.no>
JP Sugarbroad <jpsugar@google.com>
JT Olds <jtolds@xnet5.com>
Jukka-Pekka Kekkonen <karatepekka@gmail.com>
Julia Hansbrough <flowerhack@google.com>
Julian Kornberger <jk+github@digineo.de>
Julian Phillips <julian@quantumfyre.co.uk>
Julien Schmidt <google@julienschmidt.com>
Jungho Ahn <jhahn@google.com>
Jure Ham <jure.ham@zemanta.com>
Justin Nu <nuss.justin@gmail.com>
Justyn Temme <justyntemme@gmail.com>
Kai Backman <kaib@golang.org>
Kale Blankenship <kale@lemnisis.com>
Kamal Aboul-Hosn <aboulhosn@google.com>
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>
Kang Hu <hukangustc@gmail.com>
Karan Dhiman <karandhi@ca.ibm.com>
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>
Katrina Owen <katrina.owen@gmail.com>
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>
Kay Zhu <kayzhu@google.com>
KB Sriram <kbsriram@google.com>
Keegan Carruthers-Smith <keegan.csmith@gmail.com>
Kei Son <hey.calmdown@gmail.com>
Keith Ball <inflatablewoman@gmail.com>
Keith Randall <khr@golang.org>
Keith Rarick <kr@xph.us>
Kelsey Hightower <kelsey.hightower@gmail.com>
Kelvin Foo Chuan Lyi <vmirage@gmail.com>
Ken Friedenbach <kenliz@cruzio.com>
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>
Ken Sedgwick <ken@bonsai.com>
Ken Thompson <ken@golang.org>
Kenji Kaneda <kenji.kaneda@gmail.com>
Kenneth Shaw <kenshaw@gmail.com>
Kenny Grant <kennygrant@gmail.com>
Kevin Ballard <kevin@sb.org>
Kevin Burke <kev@inburke.com>
Kevin Kirsche <kev.kirsche@gmail.com>
Kevin Klues <klueska@gmail.com> <klueska@google.com>
Kevin Malachowski <chowski@google.com>

Kevin Vu <kevin.m.vu@gmail.com>
Kim Shrier <kshrier@racktopsystems.com>
Kirklin McDonald <kirklin.mcdonald@gmail.com>
Klaus Post <klauspost@gmail.com>
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>
Kris Rousey <krousey@google.com>
Kristopher Watts <traetox@gmail.com>
Kun Li <likunarmstrong@gmail.com>
Kyle Consalus <consalus@gmail.com>
Kyle Isom <kyle@gokyle.net>
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>
L Campbell <unpantsu@gmail.com>
Lai Jiangshan <eag0628@gmail.com>
Larry Hosken <lahosken@golang.org>
Larz Conwell <larzconwell@gmail.com>
LE Manh Cuong <cuong.manhle.vn@gmail.com>
Lee Hinman <hinman@gmail.com>
Lee Packham <lpackham@gmail.com>
Lewin Bormann <lewin.bormann@gmail.com>
Lloyd Dewolf <foolswisdom@gmail.com>
Lorenzo Stoakes <lstoakes@gmail.com>
Louis Kruger <louisk@google.com>
Luan Santos <cfcluan@gmail.com>
Luca Greco <luca.greco@alcacoop.it>
Lucien Stuker <lucien.stuker@gmail.com>
Lucio De Re <lucio.dere@gmail.com>
Luigi Riefolo <luigi.riefolo@gmail.com>
Luit van Drongelen <luitvd@gmail.com>
Luka Zakrajek <tr00.g33k@gmail.com>
Luke Curley <qpingu@gmail.com>
Luna Duclos <luna.duclos@palmstonegames.com>
Luuk van Dijk <lvd@golang.org> <lvd@google.com>
Lynn Boger <laboger@linux.vnet.ibm.com>
Maksym Trykur <maksym.trykur@gmail.com>
Mal Curtis <mal@mal.co.nz>
Manfred Touron <m@42.am>
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>
Manu Garg <manugarg@google.com>
Manu S Ajith <neo@codingarena.in>
Manuel Mendez <mmendez534@gmail.com>
Marc Weistroff <marc@weistroff.net>
Marc-Antoine Ruel <maruel@chromium.org>
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>
Marcel van Lohuizen <mpvl@golang.org>
Marco Hennings <marco.hennings@freiheit.com>
Marga Manterola <marga@google.com>
Marin Bai <marin.basic02@gmail.com>
Marius Nuennerich <mnu@google.com>

Mark Bucciarelli <mkbucc@gmail.com>
Mark Severson <miquella@gmail.com>
Mark Theunissen <mark.theunissen@gmail.com>
Mark Zavislak <zavislak@google.com>
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>
Marko Mikulicic <mkm@google.com>
Marko Tiikkaja <marko@joh.to>
Markus Duft <markus.duft@salomon.at>
Markus Sonderegger <marraison@gmail.com>
Markus Zimmermann <zimmski@gmail.com>
Martin Bertschler <mbertschler@gmail.com>
Martin Garton <garton@gmail.com>
Martin Hamrle <martin.hamrle@gmail.com>
Martin Kreichgauer <martinkr@google.com>
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>
Martin Neubauer <m.ne@gmx.net>
Martin Olsson <martin@minimum.se>
Marvin Stenger <marvin.stenger94@gmail.com>
Mateusz Czapliski <czapkofan@gmail.com>
Mathias Beke <git@denbeke.be>
Mathias Leppich <mleppich@muhqu.de>
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>
Matt Aimonetti <mattaimonetti@gmail.com>
Matt Bostock <matt@mattbostock.com>
Matt Brown <mdbrown@google.com>
Matt Drollette <matt@drollette.com>
Matt Jibson <matt.jibson@gmail.com>
Matt Joiner <anacrolix@gmail.com>
Matt Jones <mrjones@google.com>
Matt Layher <mdllyher@gmail.com>
Matt Reiferson <mreiferson@gmail.com>
Matt Robenolt <matt@ydekproductions.com>
Matt T. Proud <matt.proud@gmail.com>
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>
Matthew Brennan <matty.brennan@gmail.com>
Matthew Cottingham <mattcottingham@gmail.com>
Matthew Dempsey <mdempsey@google.com>
Matthew Denton <mdenton@skyportsystems.com>
Matthew Holt <Matthew.Holt+git@gmail.com>
Matthew Horsnell <matthew.horsnell@gmail.com>
Matthieu Hauglustaine <matt.hauglustaine@gmail.com>
Matthieu Olivier <olivier.matthieu@gmail.com>
Max Riveiro <kavu13@gmail.com>
Maxim Khitrov <max@mxcrypt.com>
Maxim Pimenov <mpimenov@google.com>
Maxim Ushakov <ushakov@google.com>
Maxwell Krohn <themax@gmail.com>

Meir Fischer <meirfischer@gmail.com>
Meng Zhuo <mengzhuo1203@gmail.com>
Mhd Sulhan <m.shulhan@gmail.com>
Micah Stetson <micah.stetson@gmail.com>
Michael Chaten <mchaten@gmail.com>
Michael Darakananda <pongad@google.com>
Michael Elkins <michael.elkins@gmail.com>
Michael Fraenkel <michael.fraenkel@gmail.com>
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>
Michael Hoisie <hoisie@gmail.com>
Michael Hudson-Doyle <michael.hudson@linaro.org>
Michael Kufel <golang@c.michael-kaeufl.de>
Michael Kelly <mjk@google.com>
Michael Lewis <mikelikespie@gmail.com>
Michael MacInnis <Michael.P.MacInnis@gmail.com>
Michael Marineau <michael.marineau@coreos.com>
Michael Matloob <matloob@google.com>
Michael McConville <momconville@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Michael Munday <munday@ca.ibm.com>
Michael Pearson <mipearson@gmail.com>
Michael Piatek <piatek@google.com>
Michael Pratt <mpratt@google.com>
Michael Schaller <michael@5challer.de>
Michael Shields <mshields@google.com>
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>
Michael Teichgraber <mteichgraber@gmx.de> <mt4swm@googlemail.com>
Michael Vetter <g.bluehut@gmail.com>
Michal Bohuslavsek <mbohuslavsek@gmail.com>
Michal Cierniak <cierniak@google.com>
Micha Derkacz <ziutek@inet.pl>
Michalis Kargakis <michaliskargakis@gmail.com>
Michel Lespinasse <>walken@google.com>
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>
Miguel Mendez <stxmendez@gmail.com>
Mihai Borobocea <MihaiBorobocea@gmail.com>
Mikael Tillenius <mikti42@gmail.com>
Mike Andrews <mra@xoba.com>
Mike Appleby <mike@app.leby.org>
Mike Danese <mikedanese@google.com>
Mike Houston <mike@kothar.net>
Mike Rosset <mike.rosset@gmail.com>
Mike Samuel <mikesamuel@gmail.com>
Mike Solomon <msolo@gmail.com>
Mike Strosaker <strosake@us.ibm.com>
Mikhail Gusarov <dottedmag@dottedmag.net>
Mikhail Panchenko <m@mihasya.com>

Miki Tebeka <miki.tebeka@gmail.com>
Mikio Hara <mikioh.mikioh@gmail.com>
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>
Miquel Sabat Sol <mikisabate@gmail.com>
Miroslav Genov <mgenov@gmail.com>
Mohit Agarwal <mohit@sdf.org>
Momchil Velikov <momchil.velikov@gmail.com>
Monty Taylor <mordred@inaugust.com>
Moriyoshi Koizumi <mozo@mozo.jp>
Morten Siebuhr <sbhr@sbhr.dk>
Mshe van der Sterre <moshevds@gmail.com>
Mrunal Patel <mrunalp@gmail.com>
Muhammed Uluyol <uluyol0@gmail.com>
Nan Deng <monnand@gmail.com>
Nathan John Youngman <nj@nathany.com>
Nathan Otterness <otternes@cs.unc.edu>
Nathan P Finch <nate.finch@gmail.com>
Nathan VanBenschoten <nvanbenschoten@gmail.com>
Nathan Youngman <git@nathany.com>
Nathan(yinian) Hu <nathanhu@google.com>
Neelesh Chandola <neelesh.c98@gmail.com>
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>
Niall Sheridan <nsheridan@gmail.com>
Nic Day <nic.day@me.com>
Nicholas Katsaros <nick@nickkatsaros.com>
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>
Nicholas Sullivan <nicholas.sullivan@gmail.com>
Nicholas Waples <nwaples@gmail.com>
Nick Cooper <nmvc@google.com>
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>
Nick Harper <nharper@google.com>
Nick Leli <nicholasleli@gmail.com>
Nick Patavalis <nick.patavalis@gmail.com>
Nick Petroni <npetroni@cs.umd.edu>
Nicolas Kaiser <nikai@nikai.net>
Nicolas Owens <mischief@offblast.org>
Nicolas S. Dade <nic.dade@gmail.com>
Niels Widger <niels.widger@gmail.com>
Nigel Kerr <nigel.kerr@gmail.com>
Nigel Tao <nigeltao@golang.org>
Nik Nyby <nnyby@columbia.edu>
Niko Dziemba <niko@dziemba.com>
Nikolay Turpitko <nikolay@turpitko.com>
Noah Campbell <noahcampbell@gmail.com>
Nodir Turakulov <nodir@google.com>
Norberto Lopes <nlopes.ml@gmail.com>
Odin Ugedal <odin@ugedal.com>
Oleg Vakheta <helginet@gmail.com>

Oleku Konko <oleku.konko@gmail.com>
Oling Cat <olingcat@gmail.com>
Oliver Hookins <ohookins@gmail.com>
Olivier Antoine <olivier.antoine@gmail.com>
Olivier Duperray <duperray.olivier@gmail.com>
Olivier Poitrey <rs@dailymotion.com>
Olivier Saingre <osaingre@gmail.com>
Omar Jarjur <ojarjur@google.com>
zgr Kesim <oec-go@kesim.org>
Padraig Kitterick <padraigkitterick@gmail.com>
Paolo Giarrusso <p.giarrusso@gmail.com>
Paolo Martini <mrtnpaolo@gmail.com>
Parker Moore <parkrmoore@gmail.com>
Pascal S. de Kloe <pascal@quies.net>
Patrick Crosby <patrick@stathat.com>
Patrick Gavlin <pgavlin@gmail.com>
Patrick Higgins <patrick.allen.higgins@gmail.com>
Patrick Lee <pattyshack101@gmail.com>
Patrick Mzard <patrick@mezard.eu>
Patrick Mylund Nielsen <patrick@patrickmn.com>
Patrick Riley <pfr@google.com>
Patrick Smith <pat42smith@gmail.com>
Paul A Querna <paul.querna@gmail.com>
Paul Borman <borman@google.com>
Paul Chang <paulchang@google.com>
Paul Hammond <paul@paulhammond.org>
Paul Hankin <paulhankin@google.com>
Paul Lalonde <paul.a.lalonde@gmail.com>
Paul Marks <pmarks@google.com>
Paul Meyer <paul.meyer@microsoft.com>
Paul Nasrat <pnasrat@google.com>
Paul Rosania <paul.rosania@gmail.com>
Paul Sbarra <Sbarra.Paul@gmail.com>
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>
Paul van Brouwershaven <paul@vanbrouwershaven.com>
Paul Wankadia <junyer@google.com>
Paulo Casaretto <pcasaretto@gmail.com>
Pavel Paulau <pavel.paulau@gmail.com>
Pavel Zinovkin <pavel.zinovkin@gmail.com>
Pawel Knap <pawelknap88@gmail.com>
Pawel Szczur <filemon@google.com>
Percy Wegmann <ox.to.a.cart@gmail.com>
Perry Abbott <perry.j.abbott@gmail.com>
Petar Maymoukov <petarm@gmail.com>
Peter Armitage <peter.armitage@gmail.com>
Peter Collingbourne <pcc@google.com>
Peter Froehlich <peter.hans.froehlich@gmail.com>
Peter Gonda <pgonda@google.com>

Peter Kleiweg <pkleiweg@xs4all.nl>
Peter McKenzie <petermck@google.com>
Peter Moody <pmoody@uber.com>
Peter Mundy <go.peter.90@gmail.com>
Pter Surnyi <speter.go1@gmail.com>
Pter Szab <pts@google.com>
Pter Szilgyi <peterke@gmail.com>
Peter Tseng <ptseng@squareup.com>
Peter Waldschmidt <peter@waldschmidt.com>
Peter Waller <peter.waller@gmail.com>
Peter Weinberger <pjw@golang.org>
Peter Williams <pwil3058@gmail.com>
Phil Pennock <pdp@golang.org>
Philip Brgesen <philip.brgesen@gmail.com>
Philip Hofer <phofer@umich.edu>
Philip K. Warren <pkwarren@gmail.com>
Pierre Durand <pierredurand@gmail.com>
Pierre Roullon <pierre.roullon@gmail.com>
Pieter Droogendijk <pieter@binky.org.uk>
Pietro Gagliardi <pietro10@mac.com>
Prasanna Swaminathan <prasanna@mediamath.com>
Prashant Varanasi <prashant@prashantv.com>
Preetam Jinka <pj@preet.am>
Quan Tran <qeed.quan@gmail.com>
Quan Yong Zhai <qyzhai@gmail.com>
Quentin Perez <qperez@ocs.online.net>
Quentin Smith <quentin@golang.org>
Quinn Slack <sqs@sourcegraph.com>
Quoc-Viet Nguyen <afelion@gmail.com>
Radu Berinde <radu@cockroachlabs.com>
Rafal Jeczalik <rjeczalik@gmail.com>
Rahul Chaudhry <rahulchaudhry@chromium.org>
Raif S. Naffah <go@naffah-raif.name>
Rajat Goel <rajat.goel2010@gmail.com>
Ralph Corderoy <ralph@inputplus.co.uk>
Ramesh Dharan <dharan@google.com>
Raph Levien <raph@google.com>
Raphael Geronimi <raphael.geronimi@gmail.com>
Raul Silvera <rsilvera@google.com>
Rebecca Stambler <rstambler@golang.org>
Reinaldo de Souza Jr <juniorz@gmail.com>
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>
Rhys Hiltner <rhys@justin.tv>
Ricardo Padilha <ricardospadilha@gmail.com>
Richard Barnes <rlb@ipv.sx>
Richard Crowley <r@rcrowley.org>
Richard Eric Gavaletz <gavaletz@gmail.com>
Richard Gibson <richard.gibson@gmail.com>

Richard Miller <millier.research@gmail.com>
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>
Rick Arnold <rickarnoldjr@gmail.com>
Rick Hudson <rlh@golang.org>
Riku Voipio <riku.voipio@linaro.org>
Risto Jaakko Saarelm <rsaarelm@gmail.com>
Rob Earhart <earhart@google.com>
Rob Norman <rob.norman@infinitycloud.com>
Rob Pike <r@golang.org>
Robert Daniel Kortschak <dan.kortschak@adelaide.edu.au>
Robert Dinu <r@varp.se>
Robert Figueiredo <robfig@gmail.com>
Robert Griesemer <gri@golang.org>
Robert Hencke <robert.hencke@gmail.com>
Robert Iannucci <iannucci@google.com>
Robert Obryk <robryk@gmail.com>
Robert Seseek <rseseek@google.com>
Robert Snedegar <roberts@google.com>
Robert Stepanek <robert.stepanek@gmail.com>
Robin Eklind <r.eklind.87@gmail.com>
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>
Roger Pau Monn <royger@gmail.com>
Roger Peppe <rogpeppe@gmail.com>
Roland Shoemaker <rolandshoemaker@gmail.com>
Ron Hashimoto <mail@h2so5.net>
Ron Minnich <rminnich@gmail.com>
Ross Light <light@google.com> <rlight2@gmail.com>
Rowan Worth <sqweek@gmail.com>
Rui Ueyama <ruiui@google.com>
Russ Cox <rsc@golang.org>
Russell Haering <russellhaering@gmail.com>
Ryan Bagwell <ryanbagwell@outlook.com>
Ryan Barrett <ryanb@google.com>
Ryan Brown <ribrd@b@google.com>
Ryan Hitchman <hitchmanr@gmail.com>
Ryan Lower <rpjlower@gmail.com>
Ryan Seys <ryan@ryanseys.com>
Ryan Slade <ryanslade@gmail.com>
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>
S.alar Onur <caglar@10ur.org>
Sai Cheemalapati <saicheems@google.com>
Salmn Aljammz <s@0x65.net>
Sam Ding <samding@ca.ibm.com>
Sam Hug <samuel.b.hug@gmail.com>
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>
Sam Whited <sam@samwhited.com>
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>

Sami Commerot <samic@google.com>
Samuel Tan <samueltan@google.com>
Samuele Pedroni <pedronis@lucediurna.net>
Sanjay Menakuru <balasanjay@gmail.com>
Sarah Adams <shadams@google.com>
Sasha Lionheart <lionhearts@google.com>
Sasha Sobol <sasha@scaledinference.com>
Scott Barron <scott.barron@github.com>
Scott Bell <scott@sctsm.com>
Scott Ferguson <scottwferg@gmail.com>
Scott Lawrence <bytbox@gmail.com>
Scott Mansfield <smansfield@netflix.com>
Scott Schwartz <scotts@golang.org>
Scott Van Woudenberg <scottvw@google.com>
Sean Burford <sburford@google.com>
Sean Dolphin <Sean.Dolphin@kpcompass.com>
Sean Harger <sharger@google.com>
Sean Rees <sean@erifax.org>
Sebastien Binet <seb.binet@gmail.com>
Sbastien Paolacci <sebastien.paolacci@gmail.com>
Sergei Skorobogatov <skorobo@rambler.ru>
Sergey 'Snake' Gromov <snake.scaly@gmail.com>
Sergey Arseev <sergey.arseev@intel.com>
Sergio Luis O. B. Correia <sergio@correia.cc>
Seth Hoenig <seth.a.hoenig@gmail.com>
Seth Vargo <sethvargo@gmail.com>
Shahar Kohanim <skohanim@gmail.com>
Shane Hansen <shanemhansen@gmail.com>
Shaozhen Ding <dsz0111@gmail.com>
Shawn Ledbetter <sledbetter@google.com>
Shawn Smith <shawn.p.smith@gmail.com>
Shawn Walker-Salas <shawn.walker@oracle.com>
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>
Shinji Tanaka <shinji.tanaka@gmail.com>
Shivakumar GN <shivakumar.gn@gmail.com>
Shun Fan <sfan@google.com>
Silvan Jegen <s.jegen@gmail.com>
Simon Jefford <simon.jefford@gmail.com>
Simon Rawet <simon@rawet.se>
Simon Thulbourn <simon+github@thulbourn.com>
Simon Whitehead <chemnova@gmail.com>
Sina Siadat <siadat@gmail.com>
Sokolov Yura <funny.falcon@gmail.com>
Song Gao <song@gao.io>
Spencer Nelson <s@spenczar.com>
Spring Mc <heresy.mc@gmail.com>
Srdjan Petrovic <spetrovic@google.com>
Sridhar Venkatakrishnan <sridhar@laddoo.net>

StalkR <stalkr@stalkr.net>
Stan Schwertly <stan@schwertly.com>
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>
Stphane Travostino <stephane.travostino@gmail.com>
Stephen Ma <stephenm@golang.org>
Stephen McQuay <stephen@mcquay.me>
Stephen Weinberg <stephen@q5comm.com>
Steve Francia <spf@golang.org>
Steve McCoy <mccoyst@gmail.com>
Steve Newman <snewman@google.com>
Steve Phillips <elimistev@gmail.com>
Steve Streeting <steve@stevestreeting.com>
Steven Elliot Harris <seharris@gmail.com>
Steven Hartland <steven.hartland@multiplay.co.uk>
Sugu Sougoumarane <ssougou@gmail.com>
Suharsh Sivakumar <suharshs@google.com>
Suyash <dextrous93@gmail.com>
Sven Almgren <sven@tras.se>
Sven Blumenstein <svbl@google.com>
Syohei YOSHIDA <syohex@gmail.com>
Szabolcs Nagy <nsz@port70.net>
Tad Glines <tad.glines@gmail.com>
Taj Khattrra <taj.khattrra@gmail.com>
Takashi Matsuo <tmatsuo@google.com>
Takeshi YAMANASHI <9.nashi@gmail.com>
Takuya Ueda <uedatakuya@gmail.com>
Tal Shprecher <tshprecher@gmail.com>
Tamir Duberstein <tamird@gmail.com>
Tarmigan Casebolt <tarmigan@gmail.com>
Taru Karttunen <taruti@taruti.net>
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>
Terrel Shumway <gopher@shumway.us>
Tetsuo Kiso <tetsuokiso9@gmail.com>
Than McIntosh <thanm@google.com>
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>
Thomas Alan Copeland <talan.copeland@gmail.com>
Thomas de Zeeuw <thomasdezeeuw@gmail.com>
Thomas Desrosiers <thomasdesr@gmail.com>
Thomas Habets <habets@google.com>
Thomas Kappler <tkappler@gmail.com>
Thorben Krueger <thorben.krueger@gmail.com>
Thordur Bjornsson <thorduri@secnorth.net>
Tilman Dilo <tilman.dilo@gmail.com>
Tim Cooijmans <timcooijmans@gmail.com>
Tim Ebringer <tim.ebringer@gmail.com>
Tim Henderson <tim.tadh@gmail.com>
Tim Hockin <thockin@google.com>
Tim Swast <swast@google.com>

Timo Savola <timo.savola@gmail.com>
Timo Truys <alkaloid.btx@gmail.com>
Timothy Studd <tim@timstudd.com>
Tipp Moseley <tipp@google.com>
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>
Toby Burrell <kurin@google.com>
Todd Neal <todd@tneal.org>
Todd Wang <toddwang@gmail.com>
Tom Bergan <tombergan@google.com>
Tom Heng <zhm20070928@gmail.com>
Tom Linfoord <tomlinfoord@gmail.com>
Tom Szymanski <tgs@google.com>
Tom Wilkie <tom@weave.works>
Tommy Schaefer <tommy.schaefer@teecom.com>
Tor Andersson <tor.andersson@gmail.com>
Tormod Erevik Lea <tormodlea@gmail.com>
Totoro W <tw19881113@gmail.com>
Travis Cline <travis.cline@gmail.com>
Trevor Strohman <trevor.strohman@gmail.com>
Trey Lawrence <lawrence.trey@gmail.com>
Trey Tacon <ttacon@gmail.com>
Tristan Amini <tamini01@ca.ibm.com>
Tristan Colgate <tcolgate@gmail.com>
Tristan Oohry <oohry@gmail.com>
Tudor Golubenco <tudor.g@gmail.com>
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>
Tyler Bunnell <tylerbunnell@gmail.com>
Tyler Treat <ttreat31@gmail.com>
Tzu-Jung Lee <roylee17@currant.com>
Ugorji Nwoke <ugorji@gmail.com>
Ulf Holm Nielsen <doktor@dyregod.dk>
Ulrich Kunitz <uli.kunitz@gmail.com>
Uriel Mangado <uriel@berlinblue.org>
Uttam C Pawar <uttam.c.pawar@intel.com>
Vadim Grek <vadimprog@gmail.com>
Vadim Vygonets <unixdj@gmail.com>
Vega Garcia Luis Alfonso <vegacom@gmail.com>
Victor Chudnovsky <vchudnov@google.com>
Vincent Ambo <tazjin@googlemail.com>
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>
Vincent Vanackere <vincent.vanackere@gmail.com>
Vinu Rajashekhar <vinutheraj@gmail.com>
Vish Subramanian <vish@google.com>
Vishvananda Ishaya <vishvananda@gmail.com>
Vitor De Mario <vitordemario@gmail.com>
Vlad Krasnov <vlad@cloudflare.com>
Vladimir Mihailenco <vladimir.webdev@gmail.com>
Vladimir Nikishenko <vova616@gmail.com>

Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>
Volker Dobler <dr.volker.dobler@gmail.com>
Volodymyr Paprotski <vpaprots@ca.ibm.com>
Walter Poupore <wpoupore@google.com>
Wedson Almeida Filho <wedsonaf@google.com>
Wei Guangjing <vcc.163@gmail.com>
Will Chan <willchan@google.com>
Will Norris <willnorris@google.com>
Willem van der Schyff <willemvds@gmail.com>
William Chan <willchan@chromium.org>
William Josephson <wjosephson@gmail.com>
William Orr <will@worrbase.com> <ay1244@gmail.com>
Wisdom Omuya <deafgoat@gmail.com>
Xia Bin <snyh@snyh.org>
Xing Xing <mikespook@gmail.com>
Xudong Zhang <felixmelon@gmail.com>
Xuyang Kang <xuyangkang@gmail.com>
Yan Zou <yzou@google.com>
Yann Kerherv <yann.kerherve@gmail.com>
Yao Zhang <lunaria21@gmail.com>
Yasuharu Goto <matope.ono@gmail.com>
Yasuhiro Matsumoto <mattn.jp@gmail.com>
Yesudeep Mangalapilly <yesudeep@google.com>
Yissakhar Z. Beck <yissakhar.beck@gmail.com>
Yo-An Lin <yoanlin93@gmail.com>
Yongjian Xu <i3dmaster@gmail.com>
Yorman Arias <cixtords@gmail.com>
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>
Yu Heng Zhang <annita.zhang@cn.ibm.com>
Yu Xuan Zhang <zyxsh@cn.ibm.com>
Yuki Yugui Sonoda <yugui@google.com>
Yusuke Kagiwada <block.rxckin.beats@gmail.com>
Yuusei Kuwana <kuwana@kumama.org>
Yuval Pavel Zholkover <paulzhol@gmail.com>
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>
Zac Bergquist <zbergquist99@gmail.com>
Zev Goldstein <zev.goldstein@gmail.com>
Zhongwei Yao <zhongwei.yao@arm.com>
Ziad Hatahet <hatahet@gmail.com>
Zorion Arrizabalaga <zorionk@gmail.com>
<faxriddinjon@gmail.com>
<bronze1man@gmail.com>

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1.283 libva 1.0.15

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Waldo Bastian <waldo.bastian@intel.com>
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1.284 tomcat 9.0.37

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- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
- web-fragment_3_0.xsd
- javaee_7.xsd
- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
- web-app_3_1.xsd
- web-common_3_1.xsd
- web-fragment_3_1.xsd
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- javaee_5.xsd
- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
- web-fragment_3_0.xsd
- javaee_7.xsd
- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
- web-app_3_1.xsd
- web-common_3_1.xsd
- web-fragment_3_1.xsd
- javaee_8.xsd
- web-app_4_0.xsd
- web-common_4_0.xsd
- web-fragment_4_0.xsd

may be obtained from:

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- jsp_2_2.xsd
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- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
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- web-common_3_1.xsd
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- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
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Gocheck - A rich testing framework for Go

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Go support for Protocol Buffers - Google's data interchange format

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

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

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1.286 objenesis 3.1

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1.287 atomicwrites 1.3.0

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1.288 Isof 4.85

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1.289 icu 65

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```
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## Commands to generate dependency files  
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)  
GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)  
  
## Flags for position independent code  
SHAREDLIBCFLAGS = -fPIC  
SHAREDLIBCXXFLAGS = -fPIC
```

SHAREDLIBCPPFLAGS = -DPIC

Additional flags when building libraries and with threads

THREADSCPPFLAGS = -D_REENTRANT

LIBCPPFLAGS =

Compiler switch to embed a runtime search path

LD_RPATH=

LD_RPATH_PRE= -Wl,-rpath,

Compiler switch to embed a library name

LD_SONAME = -Wl,-soname -Wl,\$(notdir \$(MIDDLE_SO_TARGET))

Shared library options

LD_SOOPTIONS= -Wl,-Bsymbolic

Shared object suffix

SO = so

Non-shared intermediate object suffix

STATIC_O = ao

Compilation rules

%. \$(STATIC_O): \$(srcdir)/%.c

\$(COMPILE.c) \$(STATICCPPFLAGS) \$(STATICCFLAGS) -o \$@ \$<

%.o: \$(srcdir)/%.c

\$(COMPILE.c) \$(DYNAMICCPPFLAGS) \$(DYNAMICCFLAGS) -o \$@ \$<

%. \$(STATIC_O): \$(srcdir)/%.cpp

\$(COMPILE.cc) \$(STATICCPPFLAGS) \$(STATICCXXFLAGS) -o \$@ \$<

%.o: \$(srcdir)/%.cpp

\$(COMPILE.cc) \$(DYNAMICCPPFLAGS) \$(DYNAMICCXXFLAGS) -o \$@ \$<

Dependency rules

%.d: \$(srcdir)/%.c

@echo "generating dependency information for \$<"

@\$(SHELL) -ec '\$(GEN_DEPS.c) \$< \

| sed "s^\(\$*\)\.o[:]*^1.o \$@ :/g\" > \$@; \

[-s \$@] || rm -f \$@'

%.d: \$(srcdir)/%.cpp

@echo "generating dependency information for \$<"

@\$(SHELL) -ec '\$(GEN_DEPS.cc) \$< \

| sed "s^\(\$*\)\.o[:]*^1.o \$@ :/g\" > \$@; \

[-s \$@] || rm -f \$@'

Versioned libraries rules

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

```
## Bind internal references
```

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

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

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

```
## End BSD-specific setup
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```

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1.290 spring-security-core 5.4.10

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*/
/**
* A token issued by { @link TokenService }.
*
* <p>
* It is important that the keys assigned to tokens are sufficiently randomised and
* secured that they can serve as identifying a unique user session. Implementations of
* { @link TokenService } are free to use encryption or encoding strategies of their choice.
* It is strongly recommended that keys are of sufficient length to balance safety against
* persistence cost. In relation to persistence cost, it is strongly recommended that
* returned keys are small enough for encoding in a cookie.
* </p>
*
* @author Ben Alex
* @since 2.0.1
*/
```

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

*/

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jar/org/springframework/security/core/session/SessionIdChangedEvent.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/session/SessionDestroyedEvent.java
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jar/org/springframework/security/authentication/ProviderManager.java
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jar/org/springframework/security/access/expression/method/MethodSecurityEvaluationContext.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/RememberMeAuthenticationTokenMixin.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UnmodifiableSetDeserializer.java
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*/

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

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/AffirmativeBased.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/AuthenticationProvider.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/event/AuthenticationFailureLockedEvent.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/annotation/Js250MethodSecurityMetadataSource.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/event/AbstractAuthenticationEvent.java

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/AuthenticationException.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/SecurityContext.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AuthorizationServiceException.java

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/event/AuthenticationFailureCredentialsExpiredEvent.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/GrantedAuthority.java

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/SecurityContextImpl.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/UsernameNotFoundException.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/AuthenticationTrustResolverImpl.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/AuthorityGranter.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/RememberMeAuthenticationProvider.java

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/ProviderNotFoundException.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AccessDecisionManager.java
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- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/BytesKeyGenerator.java
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- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/HexEncodingStringKeyGenerator.java
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- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/SecureRandomBytesKeyGenerator.java
- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/NoOpPasswordEncoder.java
- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/TextEncryptor.java
- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/StandardPasswordEncoder.java
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- * /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authorization/AuthorityReactiveAuthorizationManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/Pbkdf2PasswordEncoder.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/token/KeyBasedPersistenceTokenService.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/keygen/Base64StringKeyGenerator.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/MessageDigestPasswordEncoder.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextCallable.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/LdapShaPasswordEncoder.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/UnmodifiableListDeserializer.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/DelegatingReactiveAuthenticationManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextRunnable.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/BadCredentialsExceptionMixin.java
```

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsPasswordService.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/provisioning/JdbcUserDetailsManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/Md4PasswordEncoder.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UnmodifiableListMixin.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/Transient.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/scheduling/DelegatingSecurityContextTaskScheduler.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/annotation/CurrentSecurityContext.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/AuthenticationManagerResolver.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/scrypt/SCryptPasswordEncoder.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-

jar/org/springframework/security/core/token/SecureRandomFactoryBean.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/argon2/Argon2PasswordEncoder.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/UserDetailsRepositoryReactiveAuthenticationManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/ExpressionBasedPreInvocationAdvice.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java
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jar/org/springframework/security/crypto/bcrypt/BCryptPasswordEncoder.java
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```

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

```

Found in path(s):

```

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/AfterInvocationManager.java

```

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```

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/parameters/AnnotationParameterNameDiscoverer.java

```

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/annotation/AuthenticationPrincipal.java

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authorization/AuthorizationDecision.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/AuthenticatedPrincipal.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/ReactiveSecurityContextHolder.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/authorization/ReactiveAuthorizationManager.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/SpringSecurityCoreVersion.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/Md4.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/parameters/P.java

* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/SecurityExpressionHandler.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AuthenticationEventPublisher.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/authority/AuthorityUtils.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PostAuthorize.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PrePostInvocationAttributeFactory.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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jar/org/springframework/security/access/expression/method/ExpressionBasedPostInvocationAdvice.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/provisioning/UserDetailsManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AccountStatusUserDetailsChecker.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AccountStatusException.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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jar/org/springframework/security/access/prepost/PostFilter.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/token/Sha512DigestUtils.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/vote/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/UserDetailsChecker.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextScheduledExecutorService.java
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jar/org/springframework/security/provisioning/MutableUser.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/token/TokenService.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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jar/org/springframework/security/access/hierarchicalroles/CycleInRoleHierarchyException.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/PermissionCacheOptimizer.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/MethodSecurityExpressionHandler.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/DelegatingMethodSecurityMetadataSource.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/MethodSecurityExpressionOperations.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PreFilter.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/AuthenticationUserDetailsService.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/DenyAllPermissionEvaluator.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/aspectj/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/ComparableVersion.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PreInvocationAttribute.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-

jar/org/springframework/security/access/annotation/Js250Voter.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/aspectj/MethodInvocationAdapter.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/token/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/AbstractSecurityExpressionHandler.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/authority/mapping/MapBasedAttributes2GrantedAuthoritiesMapper.java
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jar/org/springframework/security/crypto/password/AbstractPasswordEncoder.java
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/UserDetailsByNameServiceWrapper.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/aopalliance/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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jar/org/springframework/security/access/prepost/PostInvocationAuthorizationAdvice.java
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jar/org/springframework/security/core/context/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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jar/org/springframework/security/provisioning/InMemoryUserDetailsManager.java
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jar/org/springframework/security/authentication/rcp/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/annotation/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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jar/org/springframework/security/access/prepost/PostInvocationAdviceProvider.java
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jar/org/springframework/security/access/expression/SecurityExpressionRoot.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/task/DelegatingSecurityContextAsyncTaskExecutor.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/jdbc/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/AbstractDelegatingSecurityContextSupport.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/token/DefaultToken.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/codec/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/InternalAuthenticationServiceException.java
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jar/org/springframework/security/provisioning/MutableUserDetails.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/authority/mapping/SimpleMappableAttributesRetriever.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/provisioning/GroupManager.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/AbstractExpressionBasedMethodConfigAttribute.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/util/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PreInvocationAuthorizationAdvice.java
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jar/org/springframework/security/access/expression/method/PreInvocationExpressionAttribute.java
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jar/org/springframework/security/access/event/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/AbstractFallbackMethodSecurityMetadataSource.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/cache/SpringCacheBasedUserCache.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/provisioning/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/cache/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-

jar/org/springframework/security/access/expression/method/MethodSecurityExpressionRoot.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/hierarchicalroles/package-info.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/ExpressionUtils.java
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*/
```

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* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/UserDeserializer.java
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenDeserializer.java
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*/
```

```
/**  
* Base64 encoder which is a reduced version of Robert Harder's public domain  
* implementation (version 2.3.7). See <a href=
```

```
* "http://iharder.sourceforge.net/current/java/base64/">http://iharder.sourceforge.net/current/java/base64/</a>  
* for more information.  
* <p>  
* For internal use only.  
*  
* @author Luke Taylor  
* @since 3.0  
* @deprecated Use java.util.Base64  
*/
```

Found in path(s):

```
* /opt/cola/permits/1351887212_1656319604.455229/0/spring-security-core-5-4-10-sources-  
jar/org/springframework/security/crypto/codec/Base64.java
```

1.291 activation 1.2.2

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1.292 rrule 2.6.8

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rrule.js: Library for working with recurrence rules for calendar dates.

=====

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./rrule.js and ./test/tests.js is based on python-dateutil. LICENCE:

python-dateutil - Extensions to the standard Python datetime module.

=====

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1.293 pyjwt 2.3.0

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1.294 cairo 1.14.2

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1.295 util-linux 2.28

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 */
NR START END SECTORS SIZE NAME UUID
1 32 7679 7648 3.7M 8f8378c0-01
2 7680 16383 8704 4.3M 8f8378c0-02
5 7936 12799 4864 2.4M
```

6 12544 16127 3584 1.8M

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# https://developers.google.com/open-source/cla/corporate
#
# Names should be added to this file as:
#   Name <email address>
Raul Silvera <rsilvera@google.com>
Tipp Moseley <tipp@google.com>
Hyoun Kyu Cho <netforce@google.com>
Martin Spier <spiermar@gmail.com>
Taco de Wolff <tacodewolff@gmail.com>
Andrew Hunter <andrewhunter@gmail.com>
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```

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```
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#
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# first address should be used in the submit logs and
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# Please keep the list sorted.
```

```
Aamir Khan <syst3m.w0rm@gmail.com>
Aaron Cannon <cannona@fireantproductions.com>
Aaron France <aaron.l.france@gmail.com>
Aaron Jacobs <jacobsa@google.com>
Aaron Kemp <kemp.aaron@gmail.com>
Aaron Stein <aaronstein12@gmail.com>
Aaron Torres <tcboox@gmail.com>
```

Aaron Zinman <aaron@azinman.com>
Aarti Parikh <aarti.parikh@gmail.com>
Abdullah Al Maruf <mymail.maruf@gmail.com>
Abe Haskins <abeisgreat@abeisgreat.com>
Abhinav Gupta <abhinav.g90@gmail.com>
Adam Azarchs <adam.azarchs@10xgenomics.com>
Adam Bender <abender@google.com>
Adam Eijdenberg <adam@continusec.com>
Adam Harvey <aharvey@php.net>
Adam Kisala <adam.kisala@gmail.com>
Adam Langley <agl@golang.org>
Adam Medzinski <adam.medzinski@gmail.com>
Adam Shannon <adamkshannon@gmail.com>
Adam Sindelar <adamsh@google.com>
Adam Thomason <athomason@gmail.com>
Adam Woodbeck <adam@woodbeck.net>
Adarsh Ravichandran <adarshravichandran91@gmail.com>
Aditya Mukerjee <dev@chimeracoder.net>
Adrian Hesketh <adrianhesketh@hushmail.com>
Adrian Nos <nos.adrian@gmail.com>
Adrian O'Grady <elpollouk@gmail.com>
Adrien Bustany <adrien-xx-google@bustany.org>
Adrien Petel <peteladrien@gmail.com>
Acio Jnior <aeciodantasjunior@gmail.com>
Aeneas Rekkas (arekkas) <aeneas@ory.am>
Afanasev Stanislav <phpprogger@gmail.com>
Agis Anastasopoulos <agis.anast@gmail.com>
Agniva De Sarker <agnivade@yahoo.co.in>
Ahmed Wahed <oneofone@gmail.com>
Ahmet Alp Balkan <ahmetb@google.com>
Ahmet Soormally <ahmet@mangomm.co.uk>
Ahmy Yulrizka <yulrizka@gmail.com>
Ahsun Ahmed <ahmed.ahsun@gmail.com>
Aiden Scandella <ai@uber.com>
Ainar Garipov <gugl.zadolbal@gmail.com>
Aishraj Dahal <aishraj@users.noreply.github.com>
Akhil Indurti <contact@akhilindurti.com>
Akihiro Suda <suda.kyoto@gmail.com>
Akshat Kumar <seed@mail.nanosouffle.net>
Al Cutter <al@google.com>
Alan Braithwaite <alan@ipaddr.org>
Alan Donovan <adonovan@google.com>
Alan Shreve <alan@inconshreveable.com>
Albert Nigmatzianov <albertnigma@gmail.com>
Albert Strasheim <fullung@gmail.com>
Albert Teoh <albert.teoh@gmail.com>
Albert Yu <yukinying@gmail.com>
Alberto Bertogli <albertito@blitiri.com.ar>

Alberto Donizetti <alb.donizetti@gmail.com>
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>
Aleksa Sarai <cyphar@cyphar.com>
Aleksandar Dezelin <dezelin@gmail.com>
Aleksandr Lukinykh <a.lukinykh@xsolla.com>
Aleksandr Razumov <ar@cydev.ru>
Alekseev Artem <a.artem060@gmail.com>
Alessandro Arzilli <alessandro.arzilli@gmail.com>
Alessandro Baffa <alessandro.baffa@gmail.com>
Alex A Skinner <alex@lx.lc>
Alex Brainman <alex.brainman@gmail.com>
Alex Bramley <abramley@google.com>
Alex Browne <stephenalexbrowne@gmail.com>
Alex Carol <alex.carol.c@gmail.com>
Alex Jin <toalexjin@gmail.com>
Alex Kohler <alexjohnkohler@gmail.com>
Alex Myasoedov <msoedov@gmail.com>
Alex Plugaru <alex@plugaru.org> <alexandru.plugaru@gmail.com>
Alex Schroeder <alex@gnu.org>
Alex Sergeyeu <abc@alexsergeyev.com>
Alex Tokarev <aleksator@gmail.com>
Alex Vaghin <crhyme@google.com>
Alexander Demakin <alexander.demakin@gmail.com>
Alexander Dring <email@alex.d.ch>
Alexander F Rdseth <alexander.rodseth@appeartv.com>
Alexander Guz <kalimatas@gmail.com>
Alexander Kauer <alexander@affine.space>
Alexander Kucherenko <alxkchr@gmail.com>
Alexander Larsson <alexander.larsson@gmail.com>
Alexander Lourier <aml@rulezz.ru>
Alexander Menzhinsky <amenzhinsky@gmail.com>
Alexander Morozov <lk4d4math@gmail.com>
Alexander Neumann <alexander@bumper.de>
Alexander Orlov <alexander.orlov@loxal.net>
Alexander Pantyukhin <apantykhin@gmail.com>
Alexander Polcyn <apolcyn@google.com>
Alexander Rakoczy <alex@golang.org>
Alexander Reece <awreece@gmail.com>
Alexander Surma <surma@surmair.de>
Alexander Zhavnerchik <alex.vizor@gmail.com>
Alexander Zillion <alex@alexzillion.com>
Alexander Zolotov <goldifit@gmail.com>
Alexandre Cesaro <alexandre.cesaro@gmail.com>
Alexandre Fiori <fiorix@gmail.com>
Alexandre Maari <draeron@gmail.com>
Alexandre Normand <alexandre.normand@gmail.com>
Alexandre Parentea <aubonbeurre@gmail.com>
Alexandre Viau <alexandre@alexandreviau.net>

Alexandru Mooi <brtznr@gmail.com>
Alexei Sholik <alcosholik@gmail.com>
Alexey Alexandrov <aalexand@google.com>
Alexey Borzenkov <snaury@gmail.com>
Alexey Naidonov <alexey.naidyonov@gmail.com>
Alexey Neganov <neganovalexey@gmail.com>
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>
Alexis Hildebrandt <surryhill@gmail.com>
Alexis Hunt <lexer@google.com>
Alexis Imperial-Legrand <ail@google.com>
Ali Rizvi-Santiago <arizvisa@gmail.com>
Aliaksandr Valialkin <valyala@gmail.com>
Alif Rachmawadi <subosito@gmail.com>
Allan Simon <allan.simon@supinfo.com>
Allen Li <ayatane@google.com>
Alok Menghrajani <alok.menghrajani@gmail.com>
Aman Gupta <aman@tmm1.net>
Amir Mohammad Saied <amir@gluegadget.com>
Amr Mohammed <merodiro@gmail.com>
Amrut Joshi <amrut.joshi@gmail.com>
Anand K. Mistry <anand@mistry.ninja>
Anders Pearson <anders@columbia.edu>
Anderson Queiroz <contato@andersonq.eti.br>
Andr Carvalho <asantostc@gmail.com>
Andre Nathan <andrenth@gmail.com>
Andrea Nodari <andrea.nodari91@gmail.com>
Andrea Spadaccini <spadaccio@google.com>
Andreas Auernhammer <aead@mail.de>
Andreas Jellinghaus <andreas@ionisiert.de> <anj@google.com>
Andreas Litt <andreas.litt@gmail.com>
Andrei Gherzan <andrei@resin.io>
Andrei Korzhevskii <a.korzhevskiy@gmail.com>
Andrei Matei <andrei@cockroachlabs.com>
Andrei Tudor Clin <mail@acln.ro>
Andrei Vagin <avagin@google.com>
Andrei Vieru <euvieru@gmail.com>
Andres Erbsen <andreser@google.com>
Andres Lowrie <andres.lowrie@gmail.com>
Andrew Austin <andrewacht@gmail.com>
Andrew Balholm <andybalholm@gmail.com>
Andrew Benton <andrewmbenton@gmail.com>
Andrew Bonventre <andybons@chromium.org>
Andrew Braunstein <awbraunstein@gmail.com>
Andrew Bursavich <abursavich@gmail.com>
Andrew Ekstedt <andrew.ekstedt@gmail.com>
Andrew Etter <andrew.etter@gmail.com>
Andrew Gerrand <adg@golang.org>
Andrew Harding <andrew@spacemonkey.com>

Andrew Jackura <ajackura@google.com>
Andrew Lutomirski <andy@luto.us>
Andrew Pilloud <andrewpilloud@igneoussystems.com>
Andrew Pogrebnoy <absourd.noise@gmail.com>
Andrew Poydence <apoydence@pivotal.io>
Andrew Pritchard <awpritchard@gmail.com>
Andrew Radev <andrey.radev@gmail.com>
Andrew Skiba <skibaa@gmail.com>
Andrew Stribblehill <ads@wompom.org>
Andrew Szeto <andrew@jabagawee.com>
Andrew Todd <andrew.todd@wework.com>
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>
Andrew Wilkins <axwalk@gmail.com>
Andrew Williams <williams.andrew@gmail.com>
Andrew Z Allen <me@andrewzallen.com>
Andrey Mirtchovski <mirtchovski@gmail.com>
Andrey Petrov <andrey.petrov@shazow.net>
Andrii Soldatenko <andrii.soldatenko@gmail.com>
Andrii Soluk <isoluchok@gmail.com>
Andriy Lytvynov <lytvynov.a.v@gmail.com>
Andrzej eel <andrii.zhezhel@gmail.com>
Andy Balholm <andy@balholm.com>
Andy Davis <andy@bigandian.com>
Andy Finkenstadt <afinkenstadt@zynga.com>
Andy Lindeman <andy@lindeman.io>
Andy Maloney <asmaloney@gmail.com>
Andy Walker <walkeraj@gmail.com>
Andzej Maciusovic <andzej.maciusovic@gmail.com>
Anfernee Yongkun Gui <anfernee.gui@gmail.com>
Angelo Bulfone <mbulfone@gmail.com>
Anh Hai Trinh <anh.hai.trinh@gmail.com>
Anit Gandhi <anitgandhi@gmail.com>
Ankit Goyal <ankit3goyal@gmail.com>
Anmol Sethi <anmol@aubble.com>
Anschel Schaffer-Cohen <anschelsc@gmail.com>
Anthony Alves <cvballa3g0@gmail.com>
Anthony Canino <anthony.canino1@gmail.com>
Anthony Eufemio <anthony.eufemio@gmail.com>
Anthony Fok <foka@debian.org>
Anthony Martin <ality@pbrane.org>
Anthony Sottile <asottile@umich.edu>
Anthony Starks <ajstarks@gmail.com>
Anthony Voutas <voutasaurus@gmail.com>
Anthony Woods <awoods@raintank.io>
Antoine GIRARD <sapk@sapk.fr>
Antoine Martin <antoine97.martin@gmail.com>
Anton Gyllenberg <anton@iki.fi>
Antonin Amand <antonin.amand@gmail.com>

Antonio Antelo <aantelov87@gmail.com>
Antonio Bibiano <antbbn@gmail.com>
Antonio Murdaca <runcom@redhat.com>
Antonio Troina <thoeni@gmail.com>
Aofei Sheng <aofei@aofeisheng.com>
Apisak Darakananda <pongad@gmail.com>
Aram Hvrneanu <aram@mgk.ro>
Arash Bina <arash@arash.io>
Areski Belaid <areski@gmail.com>
Ariel Mashraki <ariel@mashraki.co.il>
Arkadi Pyuro <arkadi@google.com>
Arlo Breault <arlolra@gmail.com>
Arnaud Ysmal <arnaud.ysmal@gmail.com>
Arne Hormann <arnehormann@gmail.com>
Arnout Engelen <arnout@bzzt.net>
Aron Nopanen <aron.nopanen@gmail.com>
Artem Kolin <artemkaxboy@gmail.com>
Arthur Fabre <arthur@arthurfabre.com>
Arthur Khashaev <arthur@khashaev.ru>
Artyom Pervukhin <artyom.pervukhin@gmail.com>
Arvindh Rajesh Tamilmanni <art@a-30.net>
Ashish Gandhi <ag@ashishgandhi.org>
Asim Shankar <asimshankar@gmail.com>
Atin Malaviya <amalaviy@akamai.com>
Ato Araki <ato.araki@gmail.com>
Audrey Lim <audreylh@gmail.com>
Audrius Butkevicius <audrius.butkevicius@gmail.com>
Augusto Roman <aroman@gmail.com>
Aulus Egnatius Varialus <varialus@gmail.com>
Aurlien Rainone <aurelien.rainone@gmail.com>
Austin Clements <austin@google.com> <aclements@csail.mit.edu>
Avi Flax <avi@timehop.com>
awaw fumin <awawfumin@gmail.com>
Awn Umar <awn@cryptolosophy.io>
Axel Wagner <axel.wagner.hh@googlemail.com>
Ayanamist Yang <ayanamist@gmail.com>
Aymerick Jhanne <aymerick@jehanne.org>
Azat Kaumov <kaumov.a.r@gmail.com>
Baiju Muthukadan <baiju.m.mail@gmail.com>
Balaram Makam <bmakam.qdt@qualcommdatacenter.com>
Balazs Lecz <leczb@google.com>
Baokun Lee <nototon@gmail.com>
Bartosz Grzybowski <melkorm@gmail.com>
Bartosz Oler <brtsz@google.com>
Bastian Ike <bastian.ike@gmail.com>
Ben Burkert <ben@benburkert.com>
Ben Eitzen <eitzenb@golang.org>
Ben Fried <ben.fried@gmail.com>

Ben Haines <bhainesva@gmail.com>
Ben Hoyt <benhoyt@gmail.com>
Ben Laurie <ben@links.org> <benl@google.com>
Ben Lubar <ben.lubar@gmail.com>
Ben Lynn <benlynn@gmail.com>
Ben Olive <sionide21@gmail.com>
Ben Schwartz <bemasc@google.com>
Ben Shi <powerman1st@163.com>
Benjamin Black <b@b3k.us>
Benjamin Cable <cable.benjamin@gmail.com>
Benjamin Hsieh <tanookiben@users.noreply.github.com>
Benjamin Peterson <benjamin@python.org>
Benjamin Prosnitz <bprosnitz@google.com>
Benjamin Wester <bwester@squareup.com>
Benny Siegert <bsiegert@gmail.com>
Benoit Sigoure <tsunanet@gmail.com>
Berengar Lehr <Berengar.Lehr@gmx.de>
Berkant Ipek <41230766+0xbkt@users.noreply.github.com>
Bharath Thiruveedula <tbharath91@gmail.com>
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>
Bill O'Farrell <billo@ca.ibm.com>
Bill Prin <waprin@google.com>
Bill Thiede <couchmoney@gmail.com>
Bill Zissimopoulos <billziss@navimatics.com>
Billie Harold Cleek <bhcleek@gmail.com>
Billy Lynch <wlynch@google.com>
Bjrn Erik Pedersen <bjorn.erik.pedersen@gmail.com>
Bjorn Tillenius <bjorn@tillenius.me>
Bjorn Tipling <bjorn.tipling@gmail.com>
Blain Smith <rebelgeek@blainsmith.com>
Blake Gentry <blakesgentry@gmail.com>
Blake Mesdag <blakemesdag@gmail.com>
Blake Mizerany <blake.mizerany@gmail.com>
Blixt <me@blixt.nyc>
Bob Briski <rbriski@gmail.com>
Bob Potter <bobby.potter@gmail.com>
Bobby DeSimone <bobbydesimone@gmail.com>
Bobby Powers <bobbypowers@gmail.com>
Boris Nagaev <nagaev@google.com>
Borja Clemente <borja.clemente@gmail.com>
Brad Burch <brad.burch@gmail.com>
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>
Brad Garcia <bgarcia@golang.org>
Brad Jones <rbjones@google.com>
Brad Morgan <brad@morgabra.com>
Brad Whitaker <bwhitaker@fastly.com>
Braden Bassingthwaite <bbassingthwaite@vendasta.com>
Bradley Falzon <brad@teambrad.net>

Brady Catherman <brady@gmail.com>
Brady Sullivan <brady@bsull.com>
Brandon Bennett <bbennett@fb.com>
Brandon Gilmore <varz@google.com>
Brandon Ryan <bjryan19@gmail.com>
Brendan Daniel Tracey <tracey.brendan@gmail.com>
Brendan O'Dea <bod@golang.org>
Brett Cannon <bcannon@gmail.com>
Brett Merrill <brett.j.merrill94@gmail.com>
Brian Dellisanti <briandellisanti@gmail.com>
Brian Downs <brian.downs@gmail.com>
Brian G. Merrell <bgmerrell@gmail.com>
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>
Brian Kennedy <btkenedy@gmail.com>
Brian Kessler <brian.m.kessler@gmail.com>
Brian Ketelsen <bketelsen@gmail.com>
Brian Slesinsky <skybrian@google.com>
Brian Smith <ohohvi@gmail.com>
Brian Starke <brian.starke@gmail.com>
Bryan Alexander <Kozical@msn.com>
Bryan C. Mills <bcmills@google.com>
Bryan Chan <bryan.chan@ca.ibm.com>
Bryan Ford <brynosaurus@gmail.com>
Bryan Heden <b.heden@gmail.com>
Bulat Gaifullin <gaifullinbf@gmail.com>
Burak Guven <bguven@gmail.com>
Caine Tighe <arctanofyourface@gmail.com>
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>
Caleb Martinez <accounts@calebmartinez.com>
Caleb Spare <cespare@gmail.com>
Carl Chatfield <carlchatfield@gmail.com>
Carl Henrik Lunde <chlunde@ifi.uio.no>
Carl Jackson <carl@stripe.com>
Carl Johnson <me@carlmjohnson.net>
Carl Mastrangelo <notcarl@google.com>
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>
Carlisia Campos <carlisia@grokkingtech.io>
Carlo Alberto Ferraris <cafxx@strayorange.com>
Carlos Castillo <cookieo9@gmail.com>
Carlos Cirello <uldericofilho@gmail.com>
Carlos Eduardo <me@carlosedp.com>
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>
Carlos Souza <carloshrsouza@gmail.com>
Carolyn Van Slyck <me@carolynvanslyck.com>
Carrie Bynon <cbynon@gmail.com>
Cary Hull <chull@google.com>
Case Nelson <case.nelson@gmail.com>
Casey Callendrello <squeed@gmail.com>

Casey Marshall <casey.marshall@gmail.com>
Catalin Nicutar <cnicutar@google.com>
Catalin Patulea <catalinp@google.com>
Cedric Staub <cs@squareup.com>
Cezar S Espinola <cezarsa@gmail.com>
Chad Rosier <mrosier.qdt@qualcommdatacenter.com>
ChaiShushan <chaishushan@gmail.com>
Channing Kimble-Brown <channing@golang.org>
Charles Fenwick Elliott <Charles@FenwickElliott.io>
Charles Kenney <charlesc.kenney@gmail.com>
Charles L. Dorian <cldorian@gmail.com>
Charles Lee <zombie.fml@gmail.com>
Charles Weill <weill@google.com>
Cherry Zhang <cherryz@google.com>
Chew Choon Keat <choonkeat@gmail.com>
Cholerae Hu <choleraehyq@gmail.com>
Chotepud Teo <AlexRouSg@users.noreply.github.com>
Chris Ball <chris@printf.net>
Chris Biscardi <chris@christopherbiscardi.com>
Chris Broadfoot <cbro@golang.org>
Chris Dollin <ehog.hedge@gmail.com>
Chris Farmiloe <chrisfarms@gmail.com>
Chris Hines <chris.cs.guy@gmail.com>
Chris Howey <howeyc@gmail.com>
Chris Hundt <hundt@google.com>
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>
Chris Kastorff <encryptio@gmail.com>
Chris Lennert <calennert@gmail.com>
Chris Liles <caveryliles@gmail.com>
Chris Manghane <cmang@golang.org>
Chris Marchesi <chrism@vanclueverttech.com>
Chris McGee <sirnewton_01@yahoo.ca> <newton688@gmail.com>
Chris Raynor <raynor@google.com>
Chris Roche <rodaine@gmail.com>
Chris Smith <chrsmith@users.noreply.github.com>
Chris Stockton <chrisstocktonaz@gmail.com>
Chris Zou <chriszou@ca.ibm.com>
Christian Alexander <christian@linux.com>
Christian Couder <chriscool@tuxfamily.org>
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>
Christian Muehlhaeuser <muesli@gmail.com>
Christian Pellegrin <chri@evolware.org>
Christian R. Petrin <christianpetrin@gmail.com>
Christine Hansmann <chhansmann@gmail.com>
Christoffer Buchholz <christoffer.buchholz@gmail.com>
Christoph Blecker <admin@toph.ca>
Christoph Hack <christoph@tux21b.org>
Christopher Cahoon <chris.cahoon@gmail.com>

Christopher Guiney <chris@guiney.net>
Christopher Henderson <chris@chenderson.org>
Christopher Koch <chrisko@google.com>
Christopher Nelson <nadiasvertex@gmail.com>
Christopher Nielsen <m4dh4tt3r@gmail.com>
Christopher Redden <christopher.redden@gmail.com>
Christopher Swenson <cswenson@google.com>
Christopher Wedgwood <cw@f00f.org>
Christos Zoulas <christos@zoulas.com> <zoulasc@gmail.com>
Christy Perez <christy@linux.vnet.ibm.com>
CL Sung <clsung@gmail.com> <cl_sung@htc.com>
Clment Chigot <clement.chigot@atos.net>
Clement Skau <clementskau@gmail.com>
Cody Oss <the.cody.oss@gmail.com>
Colby Ranger <cranger@google.com>
Colin Arnott <colin@urandom.co.uk>
Colin Cross <ccross@android.com>
Colin Edwards <colin@recursivepenguin.com>
Colin Kennedy <moshen.colin@gmail.com>
Colin Nelson <colnnelson@google.com>
Colin Rice <clr@google.com>
Conrad Irwin <conrad.irwin@gmail.com>
Conrad Meyer <cemeyer@cs.washington.edu>
Conrado Gouvea <conradopl@gmail.com>
Constantin Konstantinidis <constantinkonstantinidis@gmail.com>
Corey Thomasson <cthom.lists@gmail.com>
Cosmos Nicolaou <cnicolaou@google.com>
Costin Chirvasuta <ctin@google.com>
Craig Citro <craigcitro@google.com>
Cristian Staretu <unclejacksons@gmail.com>
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>
Cyrill Schumacher <cyrrill@schumacher.fm>
Daisuke Fujita <dtanshi45@gmail.com>
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>
Damian Gryski <dgryski@gmail.com>
Damien Lespiau <damien.lespiau@gmail.com> <damien.lespiau@intel.com>
Damien Mathieu <42@dmathieu.com>
Damien Neil <dneil@google.com>
Damien Tournoud <damien@platform.sh>
Dan Ballard <dan@mindstab.net>
Dan Caddigan <goldcaddy77@gmail.com>
Dan Callahan <dan.callahan@gmail.com>
Dan Harrington <harringtond@google.com>
Dan Jacques <dnj@google.com>
Dan Johnson <computerdruid@google.com>
Dan Peterson <dpiddy@gmail.com>
Dan Pupius <dan@medium.com>
Dan Sinclair <dan.sinclair@gmail.com>

Daniel Cormier <danielc@knowbe4.com>
Danil de Kok <me@danieldk.eu>
Daniel Fleischman <danielfleischman@gmail.com>
Daniel Ingram <ingramds@appstate.edu>
Daniel Johansson <dajo2002@gmail.com>
Daniel Kerwin <d.kerwin@gini.net>
Daniel Krech <eikeon@eikeon.com>
Daniel Langner <s8572327@gmail.com>
Daniel Lidn <daniel.liden.87@gmail.com>
Daniel Lublin <daniel@lublin.se>
Daniel Mart <mvdan@mvdan.cc>
Daniel Morsing <daniel.morsing@gmail.com>
Daniel Nadasi <dnadasi@google.com>
Daniel Nephin <dnephin@gmail.com>
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>
Daniel Skinner <daniel@dasa.cc>
Daniel Speichert <daniel@speichert.pl>
Daniel Theophanes <kardianos@gmail.com>
Daniel Upton <daniel@floppy.co>
Daniela Petruzalek <daniela.petruzalek@gmail.com>
Danny Rosseau <daniel.rosseau@gmail.com>
Daria Kolistratova <daria.kolistratova@intel.com>
Darien Raymond <admin@v2ray.com>
Darren Elwood <darren@textnode.com>
Darren Grant <darren.e.grant@gmail.com>
Darren McCleary <darren.rmc@gmail.com>
Darshan Parajuli <parajulidarshan@gmail.com>
Datong Sun <dndx@idndx.com>
Dave Borowitz <dborowitz@google.com>
Dave Bort <dbort@golang.org>
Dave Cheney <dave@cheney.net>
Dave Day <djd@golang.org>
Dave Grijalva <dgrijalva@ngmoco.com>
Dave MacFarlane <driusan@gmail.com>
Dave Russell <forfuncsake@gmail.com>
David Anderson <danderson@google.com>
David Barnett <dbarnett@google.com>
David Benjamin <davidben@google.com>
David Brophy <dave@brophy.uk>
David Brgin <676c7473@gmail.com>
David Calavera <david.calavera@gmail.com>
David Carlier <devn xen@gmail.com>
David Chase <drchase@google.com>
David Covert <davidhcovert@gmail.com>
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>
David du Colombier <0intro@gmail.com>
David Finkel <david.finkel@gmail.com>
David Forsythe <dforsythe@gmail.com>

David G. Andersen <dave.andersen@gmail.com>
David Glasser <glasser@meteor.com>
David Heuschmann <heuschmann.d@gmail.com>
David Howden <dhowden@gmail.com>
David Hubbard <dsp@google.com>
David Jakob Fritz <david.jakob.fritz@gmail.com>
David Jones <dxjones@gmail.com>
David Lazar <lazard@golang.org>
David Leon Gil <coruus@gmail.com>
David McLeish <davemc@google.com>
David Ndungu <dnjuguna@gmail.com>
David NewHamlet <david@newhamlet.com>
David Presotto <presotto@gmail.com>
David R. Jenni <david.r.jenni@gmail.com>
David Sansome <me@davidsansome.com>
David Stainton <dstainton415@gmail.com>
David Symonds <dsymonds@golang.org>
David Thomas <davidthomas426@gmail.com>
David Timm <dtimm@pivotal.io>
David Titarenco <david.titarenco@gmail.com>
David Tolpin <david.tolpin@gmail.com>
David Url <david@urld.io>
David Volquartz Lebech <david@lebech.info>
David Wimmer <davidlwimmer@gmail.com>
Davies Liu <davies.liu@gmail.com>
Davor Kapsa <davor.kapsa@gmail.com>
Dean Prichard <dean.prichard@gmail.com>
Deepak Jois <deepak.jois@gmail.com>
Denis Bernard <db047h@gmail.com>
Denis Brandolini <denis.brandolini@gmail.com>
Denis Nagorny <denis.nagorny@intel.com>
Dennis Kuhnert <mail.kuhnert@gmail.com>
Denys Honsiorovskyi <honsiorovskyi@gmail.com>
Denys Smirnov <denis.smirnov.91@gmail.com>
Derek Buitenhuis <derek.buitenhuis@gmail.com>
Derek Che <drc@yahoo-inc.com>
Derek McGowan <derek@mcgstyle.net>
Derek Parker <parkerderek86@gmail.com>
Derek Phan <derekphan94@gmail.com>
Derek Shockey <derek.shockey@gmail.com>
Dev Ojha <dojha12@gmail.com>
Dev Zhoujun <dev.zhoujun@gmail.com>
Devon H. O'Dell <devon.odell@gmail.com>
Dhaivat Pandit <dhaivatpandit@gmail.com>
Dhananjay Nakrani <dhananjayn@google.com>
Dhiru Kholia <dhiru.kholia@gmail.com>
Dhruvdutt Jadhav <dhruvdutt.jadhav@gmail.com>
Di Xiao <dixiao@google.com>

Didier Spezia <didier.06@gmail.com>
Diego Siqueira <diego9889@gmail.com>
Dieter Plaetinck <dieter@raintank.io>
Dimitri Sokolyuk <sokolyuk@gmail.com>
Dimitri Tcaciuc <dtcaciuc@gmail.com>
Dina Garmash <dgrmsh@gmail.com>
Diogo Pinela <diogoid7400@gmail.com>
Dirk Gadsden <dirk@esherido.com>
Diwaker Gupta <diwakergupta@gmail.com>
Dmitri Goutnik <dgoutnik@gmail.com>
Dmitri Popov <operator@cv.dp-net.com>
Dmitri Shuralyov <dmitshur@golang.org> <dmitri@shuralyov.com>
Dmitriy Cherchenko <dcherchenko@gmail.com>
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>
Dmitriy Vyukov <dvyukov@google.com>
Dmitry Chestnykh <dchest@gmail.com>
Dmitry Doroginin <doroginin@gmail.com>
Dmitry Mottl <dmitry.mottl@gmail.com>
Dmitry Neverov <dmitry.neverov@gmail.com>
Dmitry Savintsev <dsavints@gmail.com>
Dmitry Yakunin <nonamezeil@gmail.com>
Domen Ipavec <domen@ipavec.net>
Dominic Green <dominicgreen1@gmail.com>
Dominik Honnef <dominik.honnef@gmail.com>
Dominik Vogt <vogt@linux.vnet.ibm.com>
Don Byington <don@dbyington.com>
Donald Huang <don.hcd@gmail.com>
Dong-hee Na <donghee.na92@gmail.com>
Donovan Hide <donovanhide@gmail.com>
Doug Anderson <douga@google.com>
Doug Fawley <dfawley@google.com>
Douglas Danger Manley <doug.manley@gmail.com>
Drew Flower <drewvanstone@gmail.com>
Drew Hintz <adhintz@google.com>
Duncan Holm <mail@frou.org>
Dustin Carlino <dcarlino@google.com>
Dustin Herbison <djherbis@gmail.com>
Dustin Long <dustmop@gmail.com>
Dustin Sallings <dsallings@gmail.com>
Dustin Shields-Cloues <dcloues@gmail.com>
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>
Dylan Waits <dylan@waits.io>
Edan Bedrik <3d4nb3@gmail.com>
Eddie Scholtz <escholtz@google.com>
Eden Li <eden.li@gmail.com>
Eduard Urbach <e.urbach@gmail.com>
Eduardo Ramalho <eduardo.ramalho@gmail.com>

Edward Muller <edwardam@interlix.com>
Egon Elbre <egonelbre@gmail.com>
Ehren Kret <ehren.kret@gmail.com>
Eitan Adler <lists@eitanadler.com>
Eivind Uggedal <eivind@uggedal.com>
Elbert Fliek <efliek@gmail.com>
Eldar Rakhimberdin <ibeono@gmail.com>
Elena Grahovac <elena@grahovac.me>
Eli Bendersky <eliben@google.com>
Elias Naur <mail@eliasnaur.com> <elias.naur@gmail.com>
Elliot Morrison-Reed <elliottmr@gmail.com>
Emerson Lin <linyintor@gmail.com>
Emil Hessman <emil@hessman.se>
Emil Mursalimov <mursalimovemeel@gmail.com>
Emilien Kenler <hello@emilienkenler.com>
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>
Eno Compton <enocom@google.com>
Eoghan Sherry <ejsherry@gmail.com>
Eric Chiang <eric.chiang.m@gmail.com>
Eric Clark <zerohp@gmail.com>
Eric Daniels <eric@erdaniels.com>
Eric Engestrom <eric@engestrom.ch>
Eric Garrido <ekg@google.com>
Eric Koleda <ekoleda+devrel@google.com>
Eric Lagergren <ericscottlagergren@gmail.com>
Eric Milliken <emilliken@gmail.com>
Eric Pauley <eric@pauley.me>
Eric Ponce <tricokun@gmail.com>
Eric Rescorla <ekr@rtfm.com>
Eric Roshan-Eisner <eric.d.eisner@gmail.com>
Eric Rykwaldler <e.rykwaldler@gmail.com>
Erik Aigner <aigner.erik@gmail.com>
Erik Dubbelboer <erik@dubbelboer.com>
Erik St. Martin <alakriti@gmail.com>
Erik Staab <estaab@google.com>
Erik Westrup <erik.westrup@gmail.com>
Erin Masatsugu <erin.masatsugu@gmail.com>
Ernest Chiang <ernest_chiang@htc.com>
Erwin Oegema <blablaechthema@hotmail.com>
Esko Luontola <esko.luontola@gmail.com>
Ethan Burns <eaburns@google.com>
Ethan Miller <eamiller@us.ibm.com>
Euan Kemp <euank@euank.com>
Eugene Kalinin <e.v.kalinin@gmail.com>
Evan Broder <evan@stripe.com>
Evan Brown <evanbrown@google.com>
Evan Digby <evandigby@gmail.com>
Evan Hicks <evan.hicks2@gmail.com>

Evan Jones <ej@evanjones.ca>
Evan Klitzke <evan@eklitzke.org>
Evan Kroske <evankroske@google.com>
Evan Martin <evan.martin@gmail.com>
Evan Phoenix <evan@phx.io>
Evan Shaw <chickencha@gmail.com>
Evgeniy Polyakov <zbr@ioremap.net>
Ewan Chou <coocood@gmail.com>
Ewan Valentine <ewan.valentine89@gmail.com>
Eyal Posener <posener@gmail.com>
Fabian Wickborn <fabian@wickborn.net>
Fabian Zaremba <fabian@youremail.eu>
Fabrizio Milo <mistobaan@gmail.com>
Faiyaz Ahmed <ahmedf@vmware.com>
Fan Hongjian <fan.howard@gmail.com>
Fangming Fang <fangming.fang@arm.com>
Fannie Zhang <fannie.zhang@arm.com>
Fatih Arslan <fatih@arslan.io>
Fazal Majid <majid@apsalar.com>
Fazlul Shahriar <fshahriar@gmail.com>
Federico Bond <federicobond@gmail.com>
Federico Simoncelli <fsimonce@redhat.com>
Fedor Indutny <fedor@indutny.com>
Fedor Korotkiy <dartslon@gmail.com>
Felipe Oliveira <felipeweb.programador@gmail.com>
Felix Bnemann <Felix.Buenemann@gmail.com>
Felix Geisendrfer <haimuiba@gmail.com>
Felix Kollmann <fk@konsorten.de>
Filip Gruszczyski <gruszczyski@gmail.com>
Filip Haglund <drathier@users.noreply.github.com>
Filip Stanis <fstanis@google.com>
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>
Firmansyah Adiputra <frm.adiputra@gmail.com>
Florian Forster <octo@google.com>
Florian Uekermann <florian@uekermann-online.de> <fl@uekermann-online.de>
Florian Weimer <fw@deneb.enyo.de>
Florin Patan <florinpatan@gmail.com>
Folke Behrens <folke@google.com>
Ford Hurley <ford.hurley@gmail.com>
Francesc Campoy <campoy@golang.org>
Francesco Renzi <rentziass@gmail.com>
Francisco Claude <fclaude@recoded.cl>
Francisco Rojas <francisco.rojas.gallegos@gmail.com>
Francisco Souza <franciscossouza@gmail.com>
Frank Schroeder <frank.schroeder@gmail.com>
Frank Somers <fsomers@arista.com>
Frederic Guillot <frederic.guillot@gmail.com>
Frederick Kelly Mayle III <frederickmayle@gmail.com>

Frederik Ring <frederik.ring@gmail.com>
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>
Fredrik Forsmo <fredrik.forsmo@gmail.com>
Fredrik Wallgren <fredrik.wallgren@gmail.com>
Frew Schmidt <github@frew.co>
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>
Frits van Bommel <fvbommel@gmail.com>
Fumitoshi Ukai <ukai@google.com>
G. Hussain Chinoy <ghchinoy@gmail.com>
Gaal Yahas <gaal@google.com>
Gabrel Arthr Ptursson <gabriel@system.is>
Gabriel Aszalos <gabriel.aszalos@gmail.com>
Gabriel Guzman <gabe.guzman@gmail.com>
Gabriel Nelle <tehsphinx@web.de>
Gabriel Nicolas Avellaneda <avellaneda.gabriel@gmail.com>
Gabriel Russell <gabriel.russell@gmail.com>
Gareth Paul Jones <gpj@foursquare.com>
Garret Kelly <gdk@google.com>
Garrick Evans <garrick@google.com>
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>
Gary Elliott <garyelliott@google.com>
Gaurish Sharma <contact@aurishsharma.com>
Gautham Thambidorai <gautham.dorai@gmail.com>
Gauthier Jolly <gauthier.jolly@gmail.com>
Geert-Johan Riemer <gjr19912@gmail.com>
Genevieve Luyt <genevieve.luyt@gmail.com>
Gengliang Wang <ltnwgl@gmail.com>
Geoff Berry <gberry.qdt@qualcommdatacenter.com>
Geoffroy Lorieux <lorieux.g@gmail.com>
Geon Kim <geon0250@gmail.com>
Georg Reinke <guelfey@gmail.com>
George Gkirtsou <ggirtsou@gmail.com>
George Shammas <george@shamm.as> <georgyo@gmail.com>
Gerasimos (Makis) Maropoulos <kataras2006@hotmail.com>
Gerasimos Dimitriadis <gedimitr@gmail.com>
Gergely Brautigam <skarlso777@gmail.com>
Gernot Vormayr <gvormayr@gmail.com>
Getulio Snchez <valentin2507@gmail.com>
Gianguido Sora` <g.sora4@gmail.com>
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>
Giles Lean <giles.lean@pobox.com>
Giovanni Bajo <rasky@develer.com>
GitHub User @ajnrp (1688456) <ajnrp@users.noreply.github.com>
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>
GitHub User @as (8127015) <as.utf8@gmail.com>
GitHub User @bakape (7851952) <bakape@gmail.com>
GitHub User @bgadrian (830001) <aditza8@gmail.com>

GitHub User @bontequero (2674999) <bontequero@gmail.com>
GitHub User @cch123 (384546) <buaa.cch@gmail.com>
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>
GitHub User @erifan (31343225) <eric.fang@arm.com>
GitHub User @esell (9735165) <eujon.sellers@gmail.com>
GitHub User @frennk1e (6499251) <mail@rhab.de>
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>
GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>
GitHub User @kazysshr (30496953) <kazysshr0301@gmail.com>
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>
GitHub User @Kropekk (13366453) <kamilkropiewnicki@gmail.com>
GitHub User @linguohua (3434367) <lghchinaidea@gmail.com>
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>
GitHub User @madiganz (18340029) <zacharywmadigan@gmail.com>
GitHub User @micnncim (21333876) <micnncim@gmail.com>
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>
GitHub User @OlgaVIPetrova (44112727) <OVPPetrova@gmail.com>
GitHub User @pityonline (438222) <pityonline@gmail.com>
GitHub User @pytimer (17105586) <lixin20101023@gmail.com>
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>
GitHub User @tell-k (26263) <ffk2005@gmail.com>
GitHub User @uhei (2116845) <uhei@users.noreply.github.com>
GitHub User @uropek (39370426) <uropek@gmail.com>
GitHub User @utkarsh-extc (53217283) <53217283+utkarsh-extc@users.noreply.github.com>
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>
GitHub User @ZZMarquis (7624583) <zhonglingjian3821@163.com>
Giulio Iotti <dullgiulio@gmail.com>
Giulio Micheloni <giulio.micheloni@gmail.com>
Giuseppe Valente <gvalente@arista.com>
Gleb Stepanov <glebstepanov1992@gmail.com>
Glenn Brown <glennb@google.com>
Glenn Lewis <gmlewis@google.com>
Gordon Klaus <gordon.klaus@gmail.com>
Gordon Tyler <gordon@doxxx.net>
Graham King <graham4king@gmail.com>
Graham Miller <graham.miller@gmail.com>
Grant Griffiths <gdp493@gmail.com>
Greg Poirier <greg.istehbest@gmail.com>
Greg Steuck <gnezdo+github@google.com>
Greg Thelen <gthelen@google.com>
Greg Ward <greg@gerg.ca>
Grgoire Delattre <gregoire.delattre@gmail.com>
Gregory Man <man.gregory@gmail.com>
Guilherme Caruso <gui.martinscaruso@gmail.com>
Guilherme Garnier <guilherme.garnier@gmail.com>

Guilherme Goncalves <guilhermeaugustosg@gmail.com>
Guilherme Rezende <guilhermebr@gmail.com>
Guillaume J. Charmes <guillaume@charmes.net>
Guobiao Mei <meiguobiao@gmail.com>
Guoliang Wang <iamwgliang@gmail.com>
Gustav Paul <gustav.paul@gmail.com>
Gustav Westling <gustav@westling.xyz>
Gustavo Franco <gustavorfranco@gmail.com>
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>
Gwenael Treguier <gwenn.kahz@gmail.com>
Gyu-Ho Lee <gyuhox@gmail.com>
H. brahim Gngr <igungor@gmail.com>
Hajime Hoshi <hajimehoshi@gmail.com>
Hallgrimur Gunnarsson <halg@google.com>
HAMANO Tsukasa <hamano@osstech.co.jp>
Han-Wen Nienhuys <hanwen@google.com>
Hang Qian <hangqian90@gmail.com>
Hanjun Kim <hallazzang@gmail.com>
Haosdent Huang <haosdent@gmail.com>
Harald Nordgren <haraldnordgren@gmail.com>
Hari haran <hariharan.uno@gmail.com>
Hariharan Srinath <srinathh@gmail.com>
Harley Laue <losinggeneration@gmail.com>
Harry Moreno <morenoh149@gmail.com>
Harshavardhana <hrshvardhana@gmail.com>
Hasan Ozgan <hasan@ozgan.net>
Hauke Lffler <hloeffler@users.noreply.github.com>
Hvard Haugen <havard.haugen@gmail.com>
He Liu <liulonnie@gmail.com>
Hector Chu <hectorchu@gmail.com>
Hector Martin Cantero <hector@marcansoft.com>
Henning Schmiedehausen <henning@schmiedehausen.org>
Henrik Edwards <henrik.edwards@gmail.com>
Henrik Hodne <henrik@hodne.io>
Henry Adi Sumarto <henry.adisumarto@gmail.com>
Henry Bubert <google@mindeco.de>
Henry Chang <mr.changyuheng@gmail.com>
Henry Clifford <h.a.clifford@gmail.com>
Henry Wong <liushuai.wang@elastic.co>
Herbert Georg Fischer <herbert.fischer@gmail.com>
Herbie Ong <herbie@google.com>
Heschi Kreinick <heschi@google.com>
Hidetatsu Yaginuma <ygnmhdt@gmail.com>
Hilko Bengen <bengen@hilluzination.de>
Hiroaki Nakamura <hnakamur@gmail.com>
Hironao OTSUBO <motemen@gmail.com>
Hiroshi Ioka <hirochachacha@gmail.com>
Hitoshi Mitake <mitake.hitoshi@gmail.com>

Holden Huang <ttyh061@gmail.com>
Hong Ruiqi <hongruiqi@gmail.com>
Hongfei Tan <feilengcui008@gmail.com>
Horst Rutter <hhrutter@gmail.com>
Hossein Sheikh Attar <hattar@google.com>
Hsin Tsao <tsao@google.com>
Hsin-Ho Yeh <yhh92u@gmail.com>
Hu Keping <hukeping@huawei.com>
Hugues Bruant <hugues.bruant@gmail.com>
Huy Le <huy.dinh.le.89@gmail.com>
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>
Ian Cottrell <iancottrell@google.com>
Ian Davis <nospam@iandavis.com>
Ian Gudger <ian@loosescre.ws>
Ian Haken <ihaken@netflix.com>
Ian Kent <iankent85@gmail.com>
Ian Lance Taylor <iant@golang.org>
Ian Leue <ian@appboy.com>
Ian Zapolsky <ianzapolsky@gmail.com>
Ibrahim AshShohail <ibra.sho@gmail.com>
Icarus Sparry <golang@icarus.freeuk.com>
Iccha Sethi <icchasethi@gmail.com>
Idora Shinatose <idora.shinatose@gmail.com>
Igor Bernstein <igorbernstein@google.com>
Igor Dolzhikov <bluesriverz@gmail.com>
Igor Vashyst <ivashyst@gmail.com>
Igor Zhilianin <igor.zhilianin@gmail.com>
Illya Yalovyy <yalovoy@gmail.com>
Ilya Tocar <ilya.tocar@intel.com>
INADA Naoki <songofacandy@gmail.com>
Inanc Gumus <m@inanc.io>
Ingo Gottwald <in.gottwald@gmail.com>
Ingo Krabbe <ikrabbe.ask@gmail.com>
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>
Ioannis Georgoulas <geototti21@hotmail.com>
Irfan Sharif <irfanmahmoudsharif@gmail.com>
Irieda Noboru <irieda@gmail.com>
Isaac Ardis <isaac.ardis@gmail.com>
Isaac Wagner <ibw@isaacwagner.me>
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>
Issac Trotts <issactrotts@google.com>
Ivan Babrou <ivan@cloudflare.com>
Ivan Bertona <ivan.bertona@gmail.com>
Ivan Krasin <krasin@golang.org>
Ivan Kutuzov <arbrix@gmail.com>
Ivan Markin <sw@nogoegst.net>
Ivan Moscoso <moscoso@gmail.com>
Ivan Osadchiy <ivan.osadchii@gmail.com>

Ivan Sharavuev <shpiwan@gmail.com>
Ivan Ukhov <ivan.ukhov@gmail.com>
Ivy Evans <ivy@ivyevans.net>
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>
Jack Britton <jackxbritton@gmail.com>
Jack Lindamood <jlindamo@justin.tv>
Jacob Baskin <jbaskin@google.com>
Jacob Blain Christen <dweomer5@gmail.com>
Jacob H. Haven <jacob@cloudflare.com>
Jacob Hoffman-Andrews <github@hoffman-andrews.com>
Jacob Walker <jacobwalker0814@gmail.com>
Jae Kwon <jae@tendermint.com>
Jake B <doogie1012@gmail.com>
Jakob Borg <jakob@nym.se>
Jakob Weisblat <jakobw@mit.edu>
Jakub ajka <jcajka@redhat.com>
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>
James Aguilar <jaguilar@google.com>
James Bardin <j.bardin@gmail.com>
James Chacon <jchacon@google.com>
James Clarke <jrtc27@jrtc27.com>
James Cowgill <James.Cowgill@imgtec.com>
James Craig Burley <james-github@burleyarch.com>
James David Chalfant <james.chalfant@gmail.com>
James Eady <jmeady@google.com>
James Fysh <james.fysh@gmail.com>
James Gray <james@james4k.com>
James Hartig <fastest963@gmail.com>
James Lawrence <jljatone@gmail.com>
James Meneghello <rawrz0r@gmail.com>
James Myers <jfmyers9@gmail.com>
James Neve <jamesoneve@gmail.com>
James Nugent <james@jen20.com>
James P. Cooper <jamespcooper@gmail.com>
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>
James Schofield <james@shoeboxapp.com>
James Smith <jrs1995@icloud.com>
James Sweet <james.sweet88@googlemail.com>
James Toy <nil@opensesame.st>
James Treanor <jtreanor3@gmail.com>
James Tucker <raggi@google.com>
James Whitehead <jnwhiteh@gmail.com>
Jamie Beverly <jamie.r.beverly@gmail.com>
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>
Jamie Kerr <jkerr113@googlemail.com>
Jamie Liu <jamieliu@google.com>
Jamie Stackhouse <contin673@gmail.com>
Jamie Turner <jamwt@dropbox.com>

Jamie Wilkinson <jaq@spacepants.org>
Jamil Djadala <djadala@gmail.com>
Jan Berktold <jan@berktold.co>
Jan H. Hosang <jan.hosang@gmail.com>
Jan Kratochvil <jan.kratochvil@redhat.com>
Jan Lehnardt <jan@apache.org>
Jan Mercl <0xjnml@gmail.com> <befelemepeseveze@gmail.com>
Jan Newmarch <jan.newmarch@gmail.com>
Jan Pilzer <jan.pilzer@gmx.de>
Jan Steinke <jan.steinke@gmail.com>
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>
Jannis Andrija Schnitzer <jannis@schnitzer.im>
Jared Culp <jculp14@gmail.com>
Jaroslav Poepko <jp@webmaster.ms>
Jason A. Donenfeld <Jason@zx2c4.com>
Jason Barnett <jason.w.barnett@gmail.com>
Jason Buberel <jbuberel@google.com>
Jason Chu <jasonchujc@gmail.com>
Jason Del Ponte <delpontej@gmail.com>
Jason Hall <jasonhall@google.com>
Jason Keene <jasonkeene@gmail.com>
Jason LeBrun <jblebrun@gmail.com>
Jason Smale <jsmale@zendesk.com>
Jason Travis <infomaniac7@gmail.com>
Jason Wangsadinata <jwangsadinata@gmail.com>
Javier Kohen <jkohen@google.com>
Javier Revillas <jrevillas@massivedynamic.io>
Javier Segura <javism@gmail.com>
Jay Conrod <jayconrod@google.com>
Jay Taylor <outtatime@gmail.com>
Jay Weisskopf <jay@jayschwa.net>
Jean de Klerk <deklerk@google.com>
Jean-Andr Santoni <jean.andre.santoni@gmail.com>
Jean-Franois Bustarret <jf@bustarret.com>
Jean-Francois Cantin <jfcantin@gmail.com>
Jean-Marc Eurin <jmeurin@google.com>
Jean-Nicolas Moal <jn.moal@gmail.com>
Jed Denlea <jed@fastly.com>
Jeet Parekh <jeetparekh96@gmail.com>
Jeevanandam M <jeeva@myjeeva.com>
Jeff (Zhefu) Jiang <jeffjiang@google.com>
Jeff Craig <jeffcraig@google.com>
Jeff Dupont <jeff.dupont@gmail.com>
Jeff Hodges <jeff@somethingsimilar.com>
Jeff Johnson <jrjohnson@google.com>
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>
Jeff Sickel <jas@corpus-callosum.com>

Jeff Wendling <jeff@spacemonkey.com>
Jeffrey H <jeffreyh192@gmail.com>
Jelte Fennema <github-tech@jeltef.nl>
Jens Frederich <jfrederich@gmail.com>
Jeremiah Harmsen <jeremiah@google.com>
Jeremy Banks <_@jeremy.ca>
Jeremy Canady <jcanady@gmail.com>
Jeremy Jackins <jeremyjackins@gmail.com>
Jeremy Jay <jeremy@pbnjay.com>
Jeremy Schlatter <jeremy.schlatter@gmail.com>
Jeroen Bobbeldijk <jerbob92@gmail.com>
Jeroen Simonetti <jeroen@simonetti.nl>
Jerrin Shaji George <jerrinsg@gmail.com>
Jess Frazelle <me@jessfraz.com>
Jesse Szwedko <jesse.szwedko@gmail.com>
Jess Espino <jespinog@gmail.com>
Jianing Yu <jnyu@google.com>
Jianqiao Li <jianqiaoli@google.com>
Jihyun Yu <yjh0502@gmail.com>
Jim Cote <jfcote87@gmail.com>
Jim Kingdon <jim@bolt.me>
Jim McGrath <jimmc2@gmail.com>
Jim Minter <jminter@redhat.com>
Jimmy Frasche <soapboxcicero@gmail.com>
Jimmy Zelinskie <jimmyzelinskie@gmail.com>
Jin-wook Jeong <jeweljar@hanmail.net>
Jingcheng Zhang <diogin@gmail.com>
Jingguo Yao <yaojingguo@gmail.com>
Jingnan Si <jingnan.si@gmail.com>
Jinkun Zhang <franksnolf@gmail.com>
Jiong Du <londdevil@gmail.com>
Jirka Dank <dnk@mail.muni.cz>
Jiulong Wang <jiulongw@gmail.com>
Joakim Sernbrant <serbaut@gmail.com>
Joe Bowbeer <joe.bowbeer@gmail.com>
Joe Cortopassi <joe@joecortopassi.com>
Joe Farrell <joe2farrell@gmail.com>
Joe Harrison <joehazzers@gmail.com>
Joe Henke <joed.henke@gmail.com>
Joe Kyo <xunianzu@gmail.com>
Joe Poirier <jdpoirier@gmail.com>
Joe Richey <joerichey@google.com>
Joe Shaw <joe@joeshaw.org>
Joe Sylve <joe.sylve@gmail.com>
Joe Tsai <joetsai@digital-static.net>
Joel Sing <joel@sing.id.au> <jsing@google.com>
Jol Stemmer <jstemmer@google.com>
Joel Stemmer <stemmertech@gmail.com>

Joey Geiger <jgeiger@users.noreply.github.com>
Johan Brandhorst <johan.brandhorst@gmail.com>
Johan Euphrosine <proppy@google.com>
Johan Sageryd <j@1616.se>
John Asmuth <jasmuth@gmail.com>
John Beisley <huin@google.com>
John C Barstow <jbowtie@amathaine.com>
John DeNero <denero@google.com>
John Dethridge <jcd@golang.org>
John Gibb <johngibb@gmail.com>
John Gilik <john@jgilik.com>
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>
John Howard Palevich <jack.palevich@gmail.com>
John Jeffery <jjeffery@sp.com.au>
John Jenkins <twodopeshaggy@gmail.com>
John Leidegren <john.leidegren@gmail.com>
John Moore <johnkenneth.moore@gmail.com>
John Newlin <jnewlin@google.com>
John Potocny <johnp@vividcortex.com>
John R. Lenton <jlenton@gmail.com>
John Schnake <schnake.john@gmail.com>
John Shahid <jvshahid@gmail.com>
John Tuley <john@tuley.org>
John Weldon <johnweldon4@gmail.com>
Johnny Luo <johnnyluo1980@gmail.com>
Jon Chen <jchen@justin.tv>
Jonas Bernoulli <jonas@bernoul.li>
Jonathan Allie <jonallie@google.com>
Jonathan Amsterdam <jba@google.com>
Jonathan Boulle <jonathanboulle@gmail.com>
Jonathan Chen <dijonkitchen@users.noreply.github.com>
Jonathan Feinberg <feinberg@google.com>
Jonathan Gold <jgold.bg@gmail.com>
Jonathan Hseu <jhseu@google.com>
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>
Jonathan Nieder <jrn@google.com>
Jonathan Pentecost <pentecostjonathan@gmail.com>
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>
Jonathan Rudenberg <jonathan@titanous.com>
Jonathan Stacks <jonstacks13@gmail.com>
Jonathan Wills <runningwild@gmail.com>
Jonathon Lacher <jonathon.lacher@gmail.com>
Jongmin Kim <atomaths@gmail.com>
Joonas Kuorilehto <joneskoo@derbian.fi>
Joop Kieft <ikojba@gmail.com> <joop@kiefte.net>
Jordan Krage <jmank88@gmail.com>
Jordan Lewis <jordanthelewis@gmail.com>
Jordan Liggitt <liggitt@google.com>

Jordan Rhee <jordanrh@microsoft.com>
Jordi Martin <jordimartin@gmail.com>
Jorge Araya <jorgejavieran@yahoo.com.mx>
Jos Visser <josv@google.com>
Jose Luis Vazquez Gonzalez <josvazg@gmail.com>
Joseph Bonneau <jcb@google.com>
Joseph Holsten <joseph@josephholsten.com>
Josh Bleecher Snyder <josharian@gmail.com>
Josh Chorlton <jchorlton@gmail.com>
Josh Deprez <josh.deprez@gmail.com>
Josh Goebel <dreamer3@gmail.com>
Josh Hoak <jhoak@google.com>
Josh Holland <jrh@joshh.co.uk>
Josh Roppo <joshroppo@gmail.com>
Josh Varga <josh.varga@gmail.com>
Joshua Boelter <joshua.boelter@intel.com>
Joshua Chase <jcjosuachase@gmail.com>
Joshua M. Clulow <josh.clulow@joyent.com>
Joshua Rubin <joshua@rubixconsulting.com>
Josselin Costanzi <josselin@costanzi.fr>
Jostein Stuhauug <js@solidsystem.no>
JP Sugarbroad <jpsugar@google.com>
JT Olds <jtolds@xnet5.com>
JT Olio <hello@jtolio.com>
Juan Carlos <juanjcsr@gmail.com>
Juan Pablo Civile <elementohb@gmail.com>
Jude Pereira <judebpereira@gmail.com>
Jukka-Pekka Kekkonen <karatepekka@gmail.com>
Julia Hansbrough <flowerhack@google.com>
Julian Kornberger <jk+github@digineo.de>
Julian Pastarmov <pastarmovj@google.com>
Julian Phillips <julian@quantumfyre.co.uk>
Julie Qiu <julie@golang.org>
Julien Kauffmann <julien.kauffmann@freelan.org>
Julien Salleyron <julien.salleyron@gmail.com>
Julien Schmidt <google@julienschmidt.com>
Julio Montes <julio.montes@intel.com>
Junda Liu <junda@celer.network>
Jungho Ahn <jhahn@google.com>
Junya Hayashi <ledmonster@gmail.com>
Juraj Sukop <sukop@users.noreply.github.com>
Jure Ham <jure.ham@zemanta.com>
Justin Gracenin <jgracenin@gmail.com>
Justin Li <git@justinli.net>
Justin Nu <nuss.justin@gmail.com>
Justyn Temme <justyntemme@gmail.com>
Kelly Heller <pestophagous@gmail.com>
Kai Backman <kaib@golang.org>

Kai Dong <dokia2357@gmail.com>
Kai Trukenmller <ktye78@gmail.com>
Kale Blankenship <kale@lemnisis.com>
Kaleb Elwert <kelwert@atlassian.com>
Kamal Aboul-Hosn <aboulhosn@google.com>
Kamil Chmielewski <kamil.chm@gmail.com>
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>
Kamil Rytarowski <krytarowski@users.noreply.github.com>
Kang Hu <hukangustc@gmail.com>
Karan Dhiman <karandhi@ca.ibm.com>
Karel Pazdera <pazderak@gmail.com>
Karoly Negyesi <chx1975@gmail.com>
Karsten Khler <karsten.koehler95@gmail.com>
Karthik Nayak <karthik.188@gmail.com>
Kashav Madan <kshvmdn@gmail.com>
Kate Manson <kate.manson@izettle.com>
Katie Hockman <katie@golang.org>
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>
Katrina Owen <katrina.owen@gmail.com>
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>
Kay Zhu <kayzhu@google.com>
Kazuhiro Sera <seratch@gmail.com>
KB Sriram <kbsriram@google.com>
Keegan Carruthers-Smith <keegan.csmith@gmail.com>
Kei Son <hey.calmdown@gmail.com>
Keiji Yoshida <keijiyoshida.mail@gmail.com>
Keith Ball <inflatablewoman@gmail.com>
Keith Randall <khr@golang.org>
Keith Rarick <kr@xph.us>
Kelsey Hightower <kelsey.hightower@gmail.com>
Kelvin Foo Chuan Lyi <vmirage@gmail.com>
Ken Friedenbach <kenliz@cruzio.com>
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>
Ken Sedgwick <ken@bonsai.com>
Ken Thompson <ken@golang.org>
Kenichi Tsunokawa <kenichi.tsunokawa@gmail.com>
Kenji Kaneda <kenji.kaneda@gmail.com>
Kenji Yano <kenji.yano@gmail.com>
Kenneth Shaw <kenshaw@gmail.com>
Kenny Grant <kennygrant@gmail.com>
Kenta Mori <zoncoen@gmail.com>
Ketan Parmar <ketanbparmar@gmail.com>
Kevin Ballard <kevin@sb.org>
Kevin Burke <kev@inburke.com>
Kevin Gillette <extemporalgenome@gmail.com>
Kevin Kirsche <kev.kirsche@gmail.com>
Kevin Klues <klueska@gmail.com> <klueska@google.com>
Kevin Malachowski <chowski@google.com>

Kevin Ruffin <kruffin@gmail.com>
Kevin Vu <kevin.m.vu@gmail.com>
Kevin Zita <bleedgreenandgold@gmail.com>
Kieran Colford <kieran@kcolford.com>
Kim Shrier <kshrier@racktopsystems.com>
Kim Yongbin <kybinz@gmail.com>
Kir Kolyshkin <kolyshkin@gmail.com>
Kirill Motkov <Motkov.Kirill@gmail.com>
Kirill Smelkov <kirr@nexedi.com>
Kirk Han <kirk91.han@gmail.com>
Kirklin McDonald <kirklin.mcdonald@gmail.com>
Klaus Post <klauspost@gmail.com>
Kodie Goodwin <kodiegoodwin@gmail.com>
Koichi Shiraishi <zchee.io@gmail.com>
Koki Ide <niconegoto@yahoo.co.jp>
Komu Wairagu <komuw05@gmail.com>
Konstantin <konstantin8105@gmail.com>
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>
Kris Kwiatkowski <kris@cloudflare.com>
Kris Nova <kris@nivenly.com>
Kris Rousey <krousey@google.com>
Kristopher Watts <traetox@gmail.com>
Kshitij Saraogi <kshitijgaraogi@gmail.com>
Kun Li <likunarmstrong@gmail.com>
Kunpei Sakai <namusyaka@gmail.com>
Kuntal Majumder <hellozee@disroot.org>
Kyle Consalus <consalus@gmail.com>
Kyle Isom <kyle@gokyle.net>
Kyle Jones <kyle@kyledj.com>
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>
Kyle Shannon <kyle@pobox.com>
Kyle Spiers <eiais@google.com>
Kyle Wood <kyle@kylewood.cc>
Kyohei Kadota <lufia@lufia.org>
Kyrylo Silin <silin@kyrylo.org>
L Campbell <unpantsu@gmail.com>
Lai Jiangshan <eag0628@gmail.com>
Lajos Papp <lalyos@yahoo.com>
Lakshay Garg <lakshay.garg.1996@gmail.com>
Lann Martin <lannm@google.com>
Lanre Adelowo <yo@lanre.wtf>
Larry Clapp <larry@theclapp.org>
Larry Hosken <lahosken@golang.org>
Lars Jeppesen <jeppesen.lars@gmail.com>
Lars Lehtonen <lars.lehtonen@gmail.com>
Lars Wiegman <lars@namsral.com>
Larz Conwell <larzconwell@gmail.com>
Laurent Voisin <lpvoisin@gmail.com>

Laurie Clark-Michalek <laurie@qubit.com>
LE Manh Cuong <cuong.manhle.vn@gmail.com>
Lee Hinman <hinman@gmail.com>
Lee Packham <lpackham@gmail.com>
Lehner Florian <dev@der-flo.net>
Leigh McCulloch <leighmcc@gmail.com>
Leo Antunes <leo@costela.net>
Leo Rudberg <ljr@google.com>
Leon Klingele <git@leonklingele.de>
Leonardo Comelli <leonardo.comelli@gmail.com>
Leonel Quinteros <leonel.quinteros@gmail.com>
Lev Shamardin <shamardin@gmail.com>
Lewin Bormann <lewin.bormann@gmail.com>
Lion Yang <lion@aosc.xyz>
Lloyd Dewolf <foolswisdom@gmail.com>
Lorenz Bauer <lmb@cloudflare.com>
Lorenz Nickel <mail@lorenznickel.de>
Lorenzo Masini <rugginoso@develer.com>
Lorenzo Stoakes <lstoakes@gmail.com>
Louis Kruger <louisk@google.com>
Luan Santos <cfcluan@gmail.com>
Lubomir I. Ivanov <neolit123@gmail.com>
Luca Bruno <luca.bruno@coreos.com>
Luca Greco <luca.greco@alcacoop.it>
Lucas Bremgartner <lucas.bremgartner@gmail.com>
Lucas Clemente <lclemente@google.com>
Lucien Stuker <lucien.stuker@gmail.com>
Lucio De Re <lucio.dere@gmail.com>
Ludi Rehak <ludi317@gmail.com>
Luigi Riefolo <luigi.riefolo@gmail.com>
Luit van Drongelen <luitvd@gmail.com>
Luka Zakrajek <tr00.g33k@gmail.com>
Luka Zitnik <luka.zitnik@gmail.com>
Lukasz Milewski <lmmilewski@gmail.com>
Luke Champine <luke.champine@gmail.com>
Luke Curley <qpingu@gmail.com>
Luke Granger-Brown <git@lukegb.com>
Luna Duclos <luna.duclos@palmstonegames.com>
Luuk van Dijk <lvd@golang.org> <lvd@google.com>
Lyle Franklin <lylejfranklin@gmail.com>
Lynn Boger <laboger@linux.vnet.ibm.com>
Ma Peiqi <mapeiqi2017@gmail.com>
Maarten Bezemer <maarten.bezemer@gmail.com>
Maciej Dbski <maciejd@google.com>
Madhu Rajanna <madhupr007@gmail.com>
Magnus Hiie <magnus.hiie@gmail.com>
Maicon Costa <maiconscosta@gmail.com>
Mak Kolybabi <mak@kolybabi.com>

Maksym Trykur <maksym.trykur@gmail.com>
Mal Curtis <mal@mal.co.nz>
Manfred Touron <m@42.am>
Manigandan Dharmalingam <manigandan.jeff@gmail.com>
Manish Goregaokar <manishsmail@gmail.com>
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>
Mansour Rahimi <rahimi.mnr@gmail.com>
Manu Garg <manugarg@google.com>
Manu S Ajith <neo@codingarena.in>
Manuel Mendez <mmendez534@gmail.com>
Marat Khabibullin <marat.khabibullin@jetbrains.com>
Marc Weistroff <marc@weistroff.net>
Marc-Antoine Ruel <maruel@chromium.org>
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>
Marcel van Lohuizen <mpvl@golang.org>
Marcelo Cantos <marcelo.cantos@gmail.com>
Marcelo E. Magallon <marcelo.magallon@gmail.com>
Marco Hennings <marco.hennings@freiheit.com>
Marcus Willock <crazycalm@gmail.com>
Marga Manterola <marga@google.com>
Marin Bai <marin.basic02@gmail.com>
Mario Arranz <marioarranzr@gmail.com>
Marius A. Eriksen <marius@grailbio.com>
Marius Nuennerich <mnu@google.com>
Mark Adams <mark@markadams.me>
Mark Bucciarelli <mkbucc@gmail.com>
Mark Glines <mark@glines.org>
Mark Harrison <marhar@google.com>
Mark Percival <m@mdp.im>
Mark Pulford <mark@kyne.com.au>
Mark Rushakoff <mark.rushakoff@gmail.com>
Mark Ryan <mark.d.ryan@intel.com>
Mark Severson <miquella@gmail.com>
Mark Theunissen <mark.theunissen@gmail.com>
Mark Villacampa <m@markvillacampa.com>
Mark Wolfe <mark@wolfe.id.au>
Mark Zavislak <zavislak@google.com>
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>
Marko Kevac <marko@kevac.org>
Marko Mikulicic <mkm@google.com>
Marko Mudrinic <mudrinic.mare@gmail.com>
Marko Tiikkaja <marko@joh.to>
Markus Duft <markus.duft@salomon.at>
Markus Sonderegger <marraison@gmail.com>
Markus Zimmermann <zimmski@gmail.com>
Marten Seemann <martenseemann@gmail.com>
Martin Bertschler <mbertschler@gmail.com>
Martin Garton <garton@gmail.com>

Martin Habbecke <marhab@google.com>
Martin Hamrle <martin.hamrle@gmail.com>
Martin Hoefling <martin.hoefling@gmx.de>
Martin Kreichgauer <martinkr@google.com>
Martin Kunc <martinkunc@users.noreply.github.com>
Martin Lindhe <martin.j.lindhe@gmail.com>
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>
Martin Neubauer <m.ne@gmx.net>
Martin Olsen <github.com@martinolsen.net>
Martin Olsson <martin@minimum.se>
Martin Probst <martin@probst.io>
Martin Sucha <anty.sk+git@gmail.com>
Martin Tournoij <martin@arp242.net>
Martins Sipenko <martins.sipenko@gmail.com>
Martynas Budrinas <mabu@google.com>
Marvin Stenger <marvin.stenger94@gmail.com>
Marwan Sulaiman <marwan.sulaiman@work.co>
Maryan Hratson <gmarik@gmail.com>
Masahiro Furudate <masahiro.furudate@gmail.com>
Masahiro Wakame <vvakame@gmail.com>
Masaki Yoshida <yoshida.masaki@gmail.com>
Mat Byczkowski <mbyczkowski@gmail.com>
Mat Ryer <thatmatryer@gmail.com>
Mt Gulys <mgulyas86@gmail.com>
Matej Bao <matejbaco@gmail.com>
Mateus Amin <mateus.amin@gmail.com>
Mateusz Czapliski <czapkofan@gmail.com>
Mathias Beke <git@denbeke.be>
Mathias Hall-Andersen <mathias@hall-andersen.dk>
Mathias Leppich <mleppich@muhqu.de>
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>
Matt Aimonetti <mattaimonetti@gmail.com>
Matt Blair <me@matthewblair.net>
Matt Bostock <matt@mattbostock.com>
Matt Brown <mbrown@google.com>
Matt Dee <mdee@hioscar.com>
Matt Drollette <matt@drollette.com>
Matt Harden <matt.harden@gmail.com>
Matt Jibson <matt.jibson@gmail.com>
Matt Joiner <anacrolix@gmail.com>
Matt Jones <mrjones@google.com>
Matt Juran <thepciet@gmail.com>
Matt Layher <mdlayher@gmail.com>
Matt Reiferson <mreiferson@gmail.com>
Matt Robenolt <matt@ydekproductions.com>
Matt Strong <mstrong1341@gmail.com>
Matt T. Proud <matt.proud@gmail.com>

Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>
Matthew Brennan <matty.brennan@gmail.com>
Matthew Broberg <matthewbbroberg@gmail.com>
Matthew Cottingham <mattcottingham@gmail.com>
Matthew Dempsky <mdempsky@google.com>
Matthew Denton <mdenton@skyportsystems.com>
Matthew Holt <Matthew.Holt+git@gmail.com>
Matthew Horsnell <matthew.horsnell@gmail.com>
Matthew Waters <mwwaters@gmail.com>
Mathieu Hauglustaine <matt.hauglustaine@gmail.com>
Mathieu Olivier <olivier.matthieu@gmail.com>
Matthijs Kooijman <matthijs@stdin.nl>
Max Riveiro <kavu13@gmail.com>
Max Schmitt <max@schmitt.mx>
Max Semenik <maxsem.wiki@gmail.com>
Max Ushakov <ushmax@gmail.com>
Maxim Eryomenko <moeryomenko@gmail.com>
Maxim Khitrov <max@mxcrypt.com>
Maxim Pimenov <mpimenov@google.com>
Maxim Ushakov <ushakov@google.com>
Maxime de Roucy <maxime.deroucy@gmail.com>
Mximo Cuadros Ortiz <mcuadros@gmail.com>
Maxwell Krohn <themax@gmail.com>
Maya Rashish <maya@NetBSD.org>
Mayank Kumar <krmayankk@gmail.com>
Meir Fischer <meirfischer@gmail.com>
Meng Zhuo <mengzhuo1203@gmail.com>
Mhd Sulhan <m.shulhan@gmail.com>
Micah Stetson <micah.stetson@gmail.com>
Michael Anthony Knyszczek <mknyszczek@google.com>
Michael Brandenburg <mbrandenburg@bolste.com>
Michael Chaten <mchaten@gmail.com>
Michael Cook <code@mdcook.net>
Michael Darakananda <pongad@google.com>
Michael Dorner <mail@michaeldorf.de>
Michael Edwards <medwards@walledcity.ca>
Michael Elkins <michael.elkins@gmail.com>
Michael Ellis <micellis@justin.tv>
Michael Fraenkel <michael.fraenkel@gmail.com>
Michael Fromberger <michael.j.fromberger@gmail.com>
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>
Michael Henderson <mdhender@users.noreply.github.com>
Michael Hendricks <michael@ndrix.org>
Michael Hoisie <hoisie@gmail.com>
Michael Hudson-Doyle <michael.hudson@linaro.org>
Michael Kasch <michael.kasch@gmail.com>
Michael Kufl <golang@c.michael-kaeufl.de>
Michael Kelly <mjk@google.com>

Michael Lewis <mikelikespie@gmail.com>
Michael MacInnis <Michael.P.MacInnis@gmail.com>
Michael Marineau <michael.marineau@coreos.com>
Michael Matloob <matloob@google.com>
Michael McConville <momconville@gmail.com>
Michael McGreevy <mcgreevy@golang.org>
Michael McLoughlin <mmcloughlin@gmail.com>
Michael Munday <mike.munday@ibm.com>
Michael Pearson <mipearson@gmail.com>
Michael Piatek <piatek@google.com>
Michael Pratt <mpratt@google.com>
Michael Schaller <michael@5challer.de>
Michael Schurter <michael.schurter@gmail.com>
Michael Shields <mshields@google.com>
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>
Michael Steinert <mike.steinert@gmail.com>
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>
Michael Traver <mtraver@google.com>
Michael Vetter <g.bluehut@gmail.com>
Michael Vogt <mvo@ubuntu.com>
Michal Bohuslvek <mbohuslvek@gmail.com>
Michal Cierniak <cierniak@google.com>
Micha Derkacz <ziutek@lnet.pl>
Michal Franc <lam.michal.franc@gmail.com>
Michal Pristas <michal.pristas@gmail.com>
Michal Rostecki <mrostecki@suse.de>
Michalis Kargakis <michaliskargakis@gmail.com>
Michel Lespinasse <>walken@google.com>
Mickael Kerjean <mickael.kerjean@gmail.com>
Mickey Reiss <mickeyreiss@gmail.com>
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>
Miguel Mendez <stxmendez@gmail.com>
Miguel Molina <hi@mvader.me>
Mihai Borobocea <MihaiBorobocea@gmail.com>
Mihai Moldovan <ionic@ionic.de>
Mihai Todor <todormihai@gmail.com>
Mihail Minaev <minaev.mike@gmail.com>
Mikael Tillenius <mikti42@gmail.com>
Mike Andrews <mra@xoba.com>
Mike Appleby <mike@app.leby.org>
Mike Danese <mikedanese@google.com>
Mike Houston <mike@kothar.net>
Mike Kabischev <kabischev@gmail.com>
Mike Rosset <mike.rosset@gmail.com>
Mike Samuel <mikesamuel@gmail.com>
Mike Solomon <msolo@gmail.com>
Mike Strosaker <strosake@us.ibm.com>

Mike Tsao <mike@sowbug.com>
Mike Wiacek <mjwiacek@google.com>
Mikhail Gusarov <dottedmag@dottedmag.net>
Mikhail Panchenko <m@mihasya.com>
Miki Tebeka <miki.tebeka@gmail.com>
Mikio Hara <mikioh.mikioh@gmail.com>
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>
Mikoaj Baranowski <mikolajb@gmail.com>
Milan Knezevic <milan.knezevic@mips.com>
Milutin Jovanovic <jovanovic.milutin@gmail.com>
MinJae Kwon <mingrammer@gmail.com>
Miquel Sabat Sol <mikisabate@gmail.com>
Mirko Hansen <baaazen@gmail.com>
Miroslav Genov <mgenov@gmail.com>
Misty De Meo <mistydemeo@gmail.com>
Mohit Agarwal <mohit@sdf.org>
Mohit kumar Bajoria <mohitbajo36@gmail.com>
Momchil Velikov <momchil.velikov@gmail.com>
Monis Khan <mkhan@redhat.com>
Monty Taylor <mordred@inaugust.com>
Moriyoshi Koizumi <mozo@mozo.jp>
Morten Siebuhr <sbhr@sbhr.dk>
Mshe van der Sterre <moshevds@gmail.com>
Mostyn Bramley-Moore <mostyn@antipode.se>
Mrunal Patel <mrunalp@gmail.com>
Muhammad Falak R Wani <falakreyaz@gmail.com>
Muhammed Uluyol <uluyol0@gmail.com>
Muir Manders <muir@mnd.rs>
Mura Li <mura_li@castech.com.tw>
Mykhailo Lesyk <mikhail@lesyk.org>
Nan Deng <monnand@gmail.com>
Nao Yonashiro <owan.orisano@gmail.com>
Naoki Kanatani <k12naoki@gmail.com>
Nate Wilkinson <nathanwilk7@gmail.com>
Nathan Cantelmo <n.cantelmo@gmail.com>
Nathan Caza <mastercactapus@gmail.com>
Nathan Humphreys <nkhumphreys@gmail.com>
Nathan John Youngman <nj@nathany.com>
Nathan Otterness <otterness@cs.unc.edu>
Nathan P Finch <nate.finch@gmail.com>
Nathan VanBenschoten <nvanbenschoten@gmail.com>
Nathan Youngman <git@nathany.com>
Nathan(yinian) Hu <nathanhu@google.com>
Nathaniel Cook <nvcook42@gmail.com>
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>
Neelesh Chandola <neelesh.c98@gmail.com>
Neil Lyons <nwjlyons@googlemail.com>
Neuman Vong <neuman.vong@gmail.com>

Neven Sajko <nsajko@gmail.com>
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>
Niall Sheridan <nsheridan@gmail.com>
Nic Day <nic.day@me.com>
Nicholas Katsaros <nick@nickkatsaros.com>
Nicholas Maniscalco <nicholas@maniscalco.com>
Nicholas Ng <nickng@nickng.io>
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>
Nicholas Sullivan <nicholas.sullivan@gmail.com>
Nicholas Waples <nwaples@gmail.com>
Nick Anthony <Liberatys@outlook.com>
Nick Cooper <nmvc@google.com>
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>
Nick Harper <nharper@google.com>
Nick Kubala <nkubala@google.com>
Nick Leli <nicholasleli@gmail.com>
Nick Miyake <nmiyake@users.noreply.github.com>
Nick Patavalis <nick.patavalis@gmail.com>
Nick Petroni <npetroni@cs.umd.edu>
Nick Robinson <nrobinson13@gmail.com>
Nick Smolin <nick27surgut@gmail.com>
Nicolas BRULEZ <n.brulez@gmail.com>
Nicolas Kaiser <nikai@nikai.net>
Nicolas Owens <mischief@offblast.org>
Nicolas S. Dade <nic.dade@gmail.com>
Niek Sanders <niek.sanders@gmail.com>
Niels Widger <niels.widger@gmail.com>
Nigel Kerr <nigel.kerr@gmail.com>
Nigel Tao <nigeltao@golang.org>
Nik Nyby <nnyby@columbia.edu>
Nikhil Benesch <nikhil.benesch@gmail.com>
Nikita Kryuchkov <nkryuchkov10@gmail.com>
Niklas Schnelle <niklas.schnelle@gmail.com>
Niko Dziemba <niko@dziemba.com>
Nikolay Turpitko <nikolay@turpitko.com>
Nils Larsgrd <nilsmagnus@gmail.com>
Nir Soffer <nirsof@gmail.com>
Niranjan Godbole <niranjan8192@gmail.com>
Nishanth Shanmugham <nishanth.gerrard@gmail.com>
Noah Campbell <noahcampbell@gmail.com>
Noble Johnson <noblepoly@gmail.com>
Nodir Turakulov <nodir@google.com>
Noel Georgi <git@frezbo.com>
Norberto Lopes <nlopes.ml@gmail.com>
Norman B. Lancaster <qbradq@gmail.com>
Odin Ugedal <odin@ugedal.com>
Oleg Bulatov <dmage@yandex-team.ru>
Oleg Vakheta <helginet@gmail.com>

Oleku Konko <oleku.konko@gmail.com>
Oling Cat <olingcat@gmail.com>
Oliver Hookins <ohookins@gmail.com>
Oliver Stenbom <ostenbom@pivotal.io>
Oliver Tonnhofer <olt@bogsoft.com>
Olivier Antoine <olivier.antoine@gmail.com>
Olivier Duperray <duperray.olivier@gmail.com>
Olivier Poitrey <rs@dailymotion.com>
Olivier Saingre <osaingre@gmail.com>
Omar Jarjur <ojarjur@google.com>
Oryan Moshe <iamoryanmoshe@gmail.com>
Osamu TONOMORI <osamingo@gmail.com>
zgr Kesim <oec-go@kesim.org>
Pablo Lalloni <plalloni@gmail.com>
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>
Pablo Santiago Blum de Aguiar <scorpus@gmail.com>
Padraig Kitterick <padraigkitterick@gmail.com>
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>
Paolo Giarrusso <p.giarrusso@gmail.com>
Paolo Martini <mrtnpaolo@gmail.com>
Parker Moore <parkrmoore@gmail.com>
Parminder Singh <parmsingh101@gmail.com>
Pascal Dierich <pascal@pascaldierich.com>
Pascal S. de Kloe <pascal@quies.net>
Pat Moroney <pat@pat.email>
Patrick Barker <barkerp@vmware.com>
Patrick Crosby <patrick@stathat.com>
Patrick Gavlin <pgavlin@gmail.com>
Patrick Higgins <patrick.allen.higgins@gmail.com>
Patrick Lee <pattyshack101@gmail.com>
Patrick Mzard <patrick@mezard.eu>
Patrick Mylund Nielsen <patrick@patrickmn.com>
Patrick Pelletier <pp.pelletier@gmail.com>
Patrick Riley <pfr@google.com>
Patrick Smith <pat42smith@gmail.com>
Patrik Lundin <patrik@sigterm.se>
Paul A Querna <paul.querna@gmail.com>
Paul Borman <borman@google.com>
Paul Boyd <boyd.paul2@gmail.com>
Paul Chang <paulchang@google.com>
Paul Hammond <paul@paulhammond.org>
Paul Hankin <paulhankin@google.com>
Paul Jolly <paul@myitcv.org.uk>
Paul Lalonde <paul.a.lalonde@gmail.com>
Paul M Furley <paul@paulfurley.com>
Paul Marks <pmarks@google.com>
Paul Meyer <paul.meyer@microsoft.com>
Paul Nasrat <pnasrat@google.com>

Paul PISCUC <paul.piscuc@gmail.com>
Paul Querna <pquerna@apache.org>
Paul Rosania <paul.rosania@gmail.com>
Paul Ruest <pruest@gmail.com>
Paul Sbarra <Sbarra.Paul@gmail.com>
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>
Paul Tyng <paul@paultyng.net>
Paul van Brouwershaven <paul@vanbrouwershaven.com>
Paul Wankadia <junyer@google.com>
Paulo Casaretto <pcasaretto@gmail.com>
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>
Pavel Paulau <pavel.paulau@gmail.com>
Pavel Zinovkin <pavel.zinovkin@gmail.com>
Pavlo Sumkin <ymkins@gmail.com>
Pawel Knap <pawelknap88@gmail.com>
Pawel Szczur <filemon@google.com>
Percy Wegmann <ox.to.a.cart@gmail.com>
Perry Abbott <perry.j.abbott@gmail.com>
Petar Maymoukov <petarm@gmail.com>
Peter Armitage <peter.armitage@gmail.com>
Peter Bourgon <peter@bourgon.org>
Peter Collingbourne <pcc@google.com>
Peter Conerly <pconerly@gmail.com>
Peter Dotchev <dotchev@gmail.com>
Peter Froehlich <peter.hans.froehlich@gmail.com>
Peter Gonda <pgonda@google.com>
Peter Hoyes <pahoyes@gmail.com>
Peter Kleiweg <pkleiweg@xs4all.nl>
Peter McKenzie <petermck@google.com>
Peter Moody <pmoody@uber.com>
Peter Morjan <pmorjan@gmail.com>
Peter Mundy <go.peter.90@gmail.com>
Peter Nguyen <peter@mictis.com>
Pter Surnyi <speter.go1@gmail.com>
Pter Szab <pts@google.com>
Pter Szilgyi <peterke@gmail.com>
Peter Teichman <pteichman@fastly.com>
Peter Tseng <ptseng@squareup.com>
Peter Waldschmidt <peter@waldschmidt.com>
Peter Waller <peter.waller@gmail.com>
Peter Weinberger <pjw@golang.org>
Peter Williams <pwil3058@gmail.com>
Peter Wu <pwu@cloudflare.com>
Peter Zhang <i@ddatsh.com>
Petr Jedin <petr.jediny@gmail.com>
Petrica Voicu <pvoicu@paypal.com>
Phil Pearl <philip.j.r.pearl@gmail.com>
Phil Pennock <pdp@golang.org>

Philip Brgesen <philip.borgesen@gmail.com>
Philip Brown <phil@bolthole.com>
Philip Hofer <phofer@umich.edu>
Philip K. Warren <pkwarren@gmail.com>
Philip Nelson <me@pnelson.ca>
Philipp Stephani <phst@google.com>
Pierre Durand <pierredurand@gmail.com>
Pierre Prinetti <pierreprinetti@gmail.com>
Pierre Roullon <pierre.roullon@gmail.com>
Piers <google@hellowiers.pro>
Pieter Droogendijk <pieter@binky.org.uk>
Pietro Gagliardi <pietro10@mac.com>
Piyush Mishra <piyush@codeitout.com>
Plekhanov Maxim <kishtatix@gmail.com>
Pontus Leitzler <leitzler@gmail.com>
Prasanna Swaminathan <prasanna@mediamath.com>
Prashant Varanasi <prashant@prashantv.com>
Pravendra Singh <hackpravj@gmail.com>
Preetam Jinka <pj@preet.am>
Pure White <wu.purewhite@gmail.com>
Qais Patankar <qaisjp@gmail.com>
Qiuxuan Zhu <ilsh1022@gmail.com>
Quan Tran <qeed.quan@gmail.com>
Quan Yong Zhai <qyzhai@gmail.com>
Quentin Perez <qperez@ocs.online.net>
Quentin Renard <contact@asticode.com>
Quentin Smith <quentin@golang.org>
Quinn Slack <sqs@sourcegraph.com>
Quinten Yearsley <qyearsley@chromium.org>
Quoc-Viet Nguyen <afelion@gmail.com>
Radek Sohlich <sohlich@gmail.com>
Radu Berinde <radu@cockroachlabs.com>
Rafal Jeczalik <rjeczalik@gmail.com>
Raghavendra Nagaraj <jamdagni86@gmail.com>
Rahul Chaudhry <rahulchaudhry@chromium.org>
Raif S. Naffah <go@naffah-raif.name>
Rajat Goel <rajat.goel2010@gmail.com>
Rajath Agasthya <rajathagasthya@gmail.com>
Rajender Reddy Kompally <rajenderreddykompally@gmail.com>
Ralph Corderoy <ralph@inputplus.co.uk>
Ramazan AYYILDIZ <rayyildiz@gmail.com>
Ramesh Dharan <dharan@google.com>
Raph Levien <raph@google.com>
Raphael Geronimi <raphael.geronimi@gmail.com>
Raul Silvera <rsilvera@google.com>
Ravil Bikbulatov <weeellz12@gmail.com>
RaviTeja Pothana <ravi.tezu@gmail.com>
Ray Tung <rtung@thoughtworks.com>

Raymond Kazlauskas <raima220@gmail.com>
Rebecca Stambler <rstambler@golang.org>
Reilly Watson <reillywatson@gmail.com>
Reinaldo de Souza Jr <juniorz@gmail.com>
Remi Gillig <remigillig@gmail.com>
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>
Rens Rikkerink <Ikkerens@users.noreply.github.com>
Rhys Hiltner <rhys@justin.tv>
Ricardo Padilha <ricardospadilha@gmail.com>
Richard Barnes <rlb@ipv.sx>
Richard Crowley <r@rcrowley.org>
Richard Dingwall <rdingwall@gmail.com>
Richard Eric Gavaletz <gavaletz@gmail.com>
Richard Gibson <richard.gibson@gmail.com>
Richard Miller <miller.research@gmail.com>
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>
Rick Arnold <rickarnoldjr@gmail.com>
Rick Hudson <rlh@golang.org>
Rick Sayre <whorfin@gmail.com>
Rijnard van Tonder <rvantonder@gmail.com>
Riku Voipio <riku.voipio@linaro.org>
Risto Jaakko Saarelmä <rsaarelm@gmail.com>
Rob Earhart <earhart@google.com>
Rob Norman <rob.norman@infinitycloud.com>
Rob Phoenix <rob@robphoenix.com>
Rob Pike <r@golang.org>
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>
Robert Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>
Robert Dinu <r@varp.se>
Robert Figueiredo <robfig@gmail.com>
Robert Griesemer <gri@golang.org>
Robert Hencke <robert.hencke@gmail.com>
Robert Iannucci <iannucci@google.com>
Robert Obryk <robryk@gmail.com>
Robert Sesek <rsesek@google.com>
Robert Snedegar <roberts@google.com>
Robert Stepanek <robert.stepanek@gmail.com>
Robert van Gent <rvangent@google.com>
Robert-Andr Mauchin <zebob.m@gmail.com>
Roberto Clapis <robclap8@gmail.com>
Roberto Selbach <roberto@selbach.ca>
Robin Eklind <r.eklind.87@gmail.com>
Rodolfo Carvalho <rhcarvalho@gmail.com>
Rodolfo Rodriguez <rodolfobgibson@gmail.com>
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>
Roger Pau Monn <royger@gmail.com>
Roger Peppe <rogpeppe@gmail.com>

Rohan Verma <rohanverma2004@gmail.com>
Roland Illig <roland.illig@gmx.de>
Roland Shoemaker <rolandshoemaker@gmail.com>
Romain Bague <romain.bague@elwinar.com>
Roman Budnikov <romanyx90@yandex.ru>
Roman Shchekin <mrqtros@gmail.com>
Ron Hashimoto <mail@h2so5.net>
Ron Minnich <rminnich@gmail.com>
Ross Chater <rdchater@gmail.com>
Ross Light <light@google.com> <rlight2@gmail.com>
Ross Smith II <ross@smithii.com>
Rowan Marshall <rowanajmarshall@gmail.com>
Rowan Worth <sqweek@gmail.com>
Rudi Kramer <rudi.kramer@gmail.com>
Rui Ueyama <ruiui@google.com>
Ruslan Nigmatullin <elessar@dropbox.com>
Russ Cox <rsc@golang.org>
Russell Haering <russellhaering@gmail.com>
Ryan Bagwell <ryanbagwell@outlook.com>
Ryan Barrett <ryanb@google.com>
Ryan Boehning <ryan.boehning@apcera.com>
Ryan Brown <ribrdb@google.com>
Ryan Canty <jrcanty@gmail.com>
Ryan Dahl <ry@tinyclouds.org>
Ryan Hitchman <hitchmanr@gmail.com>
Ryan Lower <rpjlower@gmail.com>
Ryan Roden-Corrent <ryan@rcorre.net>
Ryan Seys <ryan@ryanseys.com>
Ryan Slade <ryanslade@gmail.com>
Ryan Zhang <ryan.zhang@docker.com>
Ryoichi KATO <ryo1kato@gmail.com>
Ryuji Iwata <qt.luigi@gmail.com>
Ryuma Yoshida <ryuma.y1117@gmail.com>
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>
S.alar Onur <caglar@10ur.org>
Sabin Mihai Rapan <sabin.rapan@gmail.com>
Sad Pencil <qh06@qq.com>
Sai Cheemalapati <saicheems@google.com>
Sakeven Jiang <jc5930@sina.cn>
Salmn Aljammz <s@0x65.net>
Sam Arnold <sarnold64@bloomberg.net>
Sam Boyer <tech@samboyer.org>
Sam Ding <samding@ca.ibm.com>
Sam Hug <samuel.b.hug@gmail.com>
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>
Sam Whited <sam@samwhited.com>
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>
Sami Commerot <samic@google.com>

Sami Pnknen <sami.ponkanen@gmail.com>
Samuel Kelemen <SCKelemen@users.noreply.github.com>
Samuel Tan <samueltan@google.com>
Samuele Pedroni <pedronis@lucediaruna.net>
Sander van Harmelen <sander@vanharmelen.nl>
Sanjay Menakuru <balasanjay@gmail.com>
Santhosh Kumar Tekuri <santhosh.tekuri@gmail.com>
Sarah Adams <shadams@google.com>
Sascha Brawer <sascha@brawer.ch>
Sasha Lionheart <lionhearts@google.com>
Sasha Sobol <sasha@scaledinference.com>
Scott Barron <scott.barron@github.com>
Scott Bell <scott@sctsm.com>
Scott Crunkleton <crunk1@gmail.com>
Scott Ferguson <scottwferg@gmail.com>
Scott Lawrence <bytbox@gmail.com>
Scott Mansfield <smansfield@netflix.com>
Scott Schwartz <scotts@golang.org>
Scott Van Woudenberg <scottvw@google.com>
Sean Burford <sburford@google.com>
Sean Chen <oohcode@gmail.com>
Sean Chittenden <seanc@joyent.com>
Sean Christopherson <sean.j.christopherson@intel.com>
Sean Dolphin <Sean.Dolphin@kpcompass.com>
Sean Harger <sharger@google.com>
Sean Rees <sean@erifax.org>
Sebastiaan van Stijn <github@gone.nl>
Sebastian Schmidt <yath@google.com>
Sebastien Binet <seb.binet@gmail.com>
Sbastien Paolacci <sebastien.paolacci@gmail.com>
Sebastien Williams-Wynn <sebastien@cytora.com>
Segev Finer <segev208@gmail.com>
Seiji Takahashi <timaki.st@gmail.com>
Sergei Skorobogatov <skorobo@rambler.ru>
Sergei Zagurskii <gvozdoder@gmail.com>
Sergey 'Snake' Gromov <snake.scaly@gmail.com>
Sergey Arseev <sergey.arseev@intel.com>
Sergey Dobrodey <sergey.dobrodey@synesis.ru>
Sergey Frolov <sfrolov@google.com>
Sergey Lukjanov <me@slukjanov.name>
Sergey Mishin <sergeymishine@gmail.com>
Sergey Mudrik <sergey.mudrik@gmail.com>
Sergey Semin <gray12511@gmail.com>
Sergey Yanykin <syanykin@ozon.ru>
Sergio Luis O. B. Correia <sergio@correia.cc>
Sergiusz Bazanski <bazanski@gmail.com>
Serhii Aheienko <serhii.aheienko@gmail.com>
Seth Hoenig <seth.a.hoenig@gmail.com>

Seth Vargo <sethvargo@gmail.com>
Shahar Kohanim <skohanim@gmail.com>
Shamil Garatuev <garatuev@gmail.com>
Shane Hansen <shanemhansen@gmail.com>
Shaozhen Ding <dsz0111@gmail.com>
Shaun Dunning <shaun.dunning@uservoice.com>
Shawn Elliott <sellott@microsoft.com>
Shawn Ledbetter <sledbetter@google.com>
Shawn Smith <shawn.p.smith@gmail.com>
Shawn Walker-Salas <shawn.walker@oracle.com>
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>
Shengjing Zhu <zs950618@gmail.com>
Shengyu Zhang <shengyu.zhang@chaitin.com>
Shi Han Ng <shihanng@gmail.com>
Shijie Hao <haormj@gmail.com>
Shinji Tanaka <shinji.tanaka@gmail.com>
Shintaro Kaneko <kaneshin0120@gmail.com>
Shivakumar GN <shivakumar.gn@gmail.com>
Shivani Singhal <shivani.singhal2804@gmail.com>
Shivansh Rai <shivansh@freebsd.org>
Shubham Sharma <shubham.sha12@gmail.com>
Shun Fan <sfan@google.com>
Silvan Jegen <s.jegen@gmail.com>
Simon Jefford <simon.jefford@gmail.com>
Simon Rawet <simon@rawet.se>
Simon Thulbourn <simon+github@thulbourn.com>
Simon Whitehead <chemnova@gmail.com>
Sina Siadat <siadat@gmail.com>
Sokolov Yura <funny.falcon@gmail.com>
Song Gao <song@gao.io>
Spencer Nelson <s@spenczar.com>
Spencer Tung <spencertung@google.com>
Spring Mc <heresy.mc@gmail.com>
Srdjan Petrovic <spetrovic@google.com>
Sridhar Venkatakrishnan <sridhar@laddoo.net>
StalkR <stalkr@stalkr.net>
Stan Schwertly <stan@schwertly.com>
Stanislav Afanasev <php.progger@gmail.com>
Steeve Morin <steeve.morin@gmail.com>
Stefan Baebler <sbaebler@outbrain.com>
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>
Stepan Shabalin <neverliberty@gmail.com>
Stephan Renatus <srenatus@chef.io>
Stephan Zuercher <zuercher@gmail.com>
Stephane Travostino <stephane.travostino@gmail.com>
Stephen Lewis <stephen@sock.org.uk>
Stephen Lu <steuhs@users.noreply.github.com>
Stephen Ma <stephenm@golang.org>

Stephen McQuay <stephen@mcquay.me>
Stephen Searles <stephens2424@gmail.com>
Stephen Weinberg <stephen@q5comm.com>
Steve Francia <spf@golang.org>
Steve Gilbert <stevegilbert23@gmail.com>
Steve LoFurno <slofurno@gmail.com>
Steve McCoy <mccoyst@gmail.com>
Steve Mynott <steve.mynott@gmail.com>
Steve Newman <snewman@google.com>
Steve Phillips <elimisteve@gmail.com>
Steve Streeting <steve@stevestreeting.com>
Steven Buss <sbuss@google.com>
Steven Elliot Harris <seharris@gmail.com>
Steven Erenst <stevenerenst@gmail.com>
Steven Hartland <steven.hartland@multiplay.co.uk>
Steven Littlebrant <imgroxx@gmail.com>
Steven Wilkin <stevenwilkin@gmail.com>
Stuart Jansen <sjansen@buscaluz.org>
Sue Spence <virtuallysue@gmail.com>
Sugu Sougoumarane <ssougou@gmail.com>
Suharsh Sivakumar <suharshs@google.com>
Sukrit Handa <sukrit.handa@utoronto.ca>
Sunny <me@darkowlzz.space>
Suriyaa Sundararuban <suriyaasundararuban@gmail.com>
Suyash <dextrous93@gmail.com>
Suzy Mueller <suzmue@golang.org>
Sven Almgren <sven@tras.se>
Sven Blumenstein <svbl@google.com>
Sylvain Zimmer <sylvain@sylvainzimmer.com>
Syohei YOSHIDA <syohex@gmail.com>
Szabolcs Nagy <nsz@port70.net>
Taavi Kivisik <taavi.kivisik@gmail.com>
Tad Fisher <tadfisher@gmail.com>
Tad Glines <tad.glines@gmail.com>
Tadas Valiukas <tadovas@gmail.com>
Taesu Pyo <pyotaesu@gmail.com>
Tai Le <letientai299@gmail.com>
Taj Khattrra <taj.khattrra@gmail.com>
Takashi Matsuo <tmatsuo@google.com>
Takayoshi Nishida <takayoshi.nishida@gmail.com>
Takeshi YAMANASHI <9.nashi@gmail.com>
Takuto Ikuta <tikuta@google.com>
Takuya Ueda <uedatakuya@gmail.com>
Tal Shprecher <tshprecher@gmail.com>
Tamir Duberstein <tamird@gmail.com>
Tao Shen <shentaoskyking@gmail.com>
Tao Wang <twang2218@gmail.com>
Tarmigan Casebolt <tarmigan@gmail.com>

Taro Aoki <aizu.s1230022@gmail.com>
Taru Karttunen <taruti@taruti.net>
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>
Tatsuya Kaneko <m.ddotx.f@gmail.com>
Taufiq Rahman <taufiqrx8@gmail.com>
Teague Cole <tnc1443@gmail.com>
Ted Kornish <golang@tedkornish.com>
Tejasvi Nareddy <tejunareddy@gmail.com>
Terin Stock <terinjokes@gmail.com>
Terrel Shumway <gopher@shumway.us>
Tetsuo Kiso <tetsuokiso9@gmail.com>
Than McIntosh <thanm@google.com>
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>
Thanatat Tamtan <acoshift@gmail.com>
Thiago Avelino <t@avelino.xxx>
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>
Thomas Alan Copeland <talan.copeland@gmail.com>
Thomas Bonfort <thomas.bonfort@gmail.com>
Thomas Bouldin <inlined@google.com>
Thomas Bruyelle <thomas.bruyelle@gmail.com>
Thomas Bushnell, BSG <tbushnell@google.com>
Thomas de Zeeuw <thomasdezeeuw@gmail.com>
Thomas Desrosiers <thomasdesr@gmail.com>
Thomas Habets <habets@google.com>
Thomas Kappler <tkappler@gmail.com>
Thomas Meson <zllak@hycik.org>
Thomas Wanielista <tomwans@gmail.com>
Thorben Krueger <thorben.krueger@gmail.com>
Thordur Bjornsson <thorduri@secnorth.net>
Tiago Queiroz <contato@tiago.eti.br>
Tianon Gravi <admwiggin@gmail.com>
Tilman Dilo <tilman.dilo@gmail.com>
Tim Cooijmans <timcooijmans@gmail.com>
Tim Cooper <tim.cooper@layeh.com>
Tim Ebringer <tim.ebringer@gmail.com>
Tim Heckman <t@heckman.io>
Tim Henderson <tim.tadh@gmail.com>
Tim Hockin <thockin@google.com>
Tim Swast <swast@google.com>
Tim Wright <tenortim@gmail.com>
Tim Xu <xiaoxubeii@gmail.com>
Timo Savola <timo.savola@gmail.com>
Timo Truys <alkaloid.btx@gmail.com>
Timothy Studd <tim@timstudd.com>
Tipp Moseley <tipp@google.com>
Tobias Assarsson <tobias.assarsson@gmail.com>
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>
Tobias Klauser <tklauser@distanz.ch>

Toby Burress <kurin@google.com>
Todd Kulesza <tkulesza@google.com>
Todd Neal <todd@tneal.org>
Todd Wang <toddwang@gmail.com>
Tom Anthony <git@tomanthony.co.uk>
Tom Bergan <tombergan@google.com>
Tom Heng <zhm20070928@gmail.com>
Tom Lanyon <tomlanyon@google.com>
Tom Levy <tomlevy93@gmail.com>
Tom Limoncelli <tal@whatexit.org>
Tom Linfoord <tomlinfoord@gmail.com>
Tom Payne <twpayne@gmail.com>
Tom Szymanski <tgs@google.com>
Tom Thorogood <me+google@tomthorogood.co.uk>
Tom Wilkie <tom@weave.works>
Tommy Schaefer <tommy.schaefer@teecom.com>
Tomoya Ishizaki <zaq1tomo@gmail.com>
Tonis Tiigi <tonistiigi@gmail.com>
Tony Reix <tony.reix@bull.net>
Tony Walker <walkert.uk@gmail.com>
Tooru Takahashi <tooru.takahashi134@gmail.com>
Tor Andersson <tor.andersson@gmail.com>
Tormod Erevik Lea <tormodlea@gmail.com>
Toshihiro Shiino <shiino.toshihiro@gmail.com>
Toshiki Shima <hayabusa1419@gmail.com>
Totoro W <tw19881113@gmail.com>
Travis Bischel <travis.bischel@gmail.com>
Travis Cline <travis.cline@gmail.com>
Trevor Strohman <trevor.strohman@gmail.com>
Trey Lawrence <lawrence.trey@gmail.com>
Trey Roessig <trey.roessig@gmail.com>
Trey Tacon <ttacon@gmail.com>
Tristan Amini <tamini01@ca.ibm.com>
Tristan Colgate <tcolgate@gmail.com>
Tristan Ooohry <ooohry@gmail.com>
Tristan Rice <rice@fn.lc>
Troels Thomsen <troels@thomsen.io>
Trung Nguyen <trung.n.k@gmail.com>
Tudor Golubenco <tudor.g@gmail.com>
Tugdual Saunier <tugdual.saunier@gmail.com>
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>
Tyler Bui-Palsulich <tpalsulich@google.com>
Tyler Bunnell <tylerbunnell@gmail.com>
Tyler Treat <ttreat31@gmail.com>
Tzu-Jung Lee <roylee17@currant.com>
Udalov Max <re.udalov@gmail.com>
Ugorji Nwoke <ugorji@gmail.com>
Ulf Holm Nielsen <doktor@dyregod.dk>

Ulrich Kunitz <uli.kunitz@gmail.com>
Umang Parmar <umangjparmar@gmail.com>
Uriel Mangado <uriel@berlinblue.org>
Urvil Patel <patelurvil38@gmail.com>
Uttam C Pawar <uttam.c.pawar@intel.com>
Vadim Grek <vadimprog@gmail.com>
Vadim Vygonets <unixdj@gmail.com>
Val Polouchkine <vpolouch@justin.tv>
Valentin Vidic <vvidic@valentin-vidic.from.hr>
Vega Garcia Luis Alfonso <vegacom@gmail.com>
Venil Noronha <veniln@vmware.com>
Veselkov Konstantin <kostozyb@gmail.com>
Viacheslav Poturaev <vearutop@gmail.com>
Victor Chudnovsky <vchudnov@google.com>
Victor Vrantchan <vrancean+github@gmail.com>
Vignesh Ramachandra <vickyramachandra@gmail.com>
Vikas Kedia <vikask@google.com>
Vincent Ambo <tazjin@googlemail.com>
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>
Vincent Vanackere <vincent.vanackere@gmail.com>
Vinu Rajashekhar <vinutheraj@gmail.com>
Vish Subramanian <vish@google.com>
Vishvananda Ishaya <vishvananda@gmail.com>
Visweswara R <r.visweswara@gmail.com>
Vitor De Mario <vitordemario@gmail.com>
Vivek Sekhar <vsekhar@google.com>
Vlad Krasnov <vlad@cloudflare.com>
Vladimir Kovpak <cn007b@gmail.com>
Vladimir Kuzmin <vkuzmin@uber.com>
Vladimir Mihailenco <vladimir.webdev@gmail.com>
Vladimir Nikishenko <vova616@gmail.com>
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>
Vladimir Varankin <nek.narqo@gmail.com>
Volker Dobler <dr.volker.dobler@gmail.com>
Volodymyr Paprotski <vpaprots@ca.ibm.com>
W. Trevor King <wking@tremily.us>
Wade Simmons <wade@wades.im>
Wagner Riffel <wgriffel@gmail.com>
Walter Poupore <wpoupore@google.com>
Wander Lairson Costa <wcosta@mozilla.com>
Warren Fernandes <warren.f.fernandes@gmail.com>
Wayne Ashley Berry <wayneashleyberry@gmail.com>
Wedson Almeida Filho <wedsonaf@google.com>
Weerasak Chongnguluam <singpor@gmail.com>
Wi Cngru <crvv.mail@gmail.com>
Wei Fu <fhfuwei@163.com>
Wei Guangjing <vcc.163@gmail.com>
Wei Xiao <wei.xiao@arm.com>

Wei Xikai <xykwei@gmail.com>
Weichao Tang <tevic.tt@gmail.com>
Wembley G. Leach, Jr <wembley.gl@gmail.com>
Wenlei (Frank) He <wlhe@google.com>
Wenzel Lowe <lowewenzel@gmail.com>
Wil Selwood <wselwood@gmail.com>
Wilfried Teiken <wteiken@google.com>
Will Beason <willbeason@gmail.com>
Will Chan <willchan@google.com>
Will Faught <will.faught@gmail.com>
Will Morrow <wmorrow.qdt@qualcommdatacenter.com>
Will Norris <willnorris@google.com>
Will Storey <will@summercat.com>
Willem van der Schyff <willemvds@gmail.com>
William Chan <willchan@chromium.org>
William Chang <mr.williamchang@gmail.com>
William Josephson <wjosephson@gmail.com>
William Orr <will@worrbase.com> <ay1244@gmail.com>
Wisdom Omuya <deafgoat@gmail.com>
Wu Yunzhou <yunzhouwu@gmail.com>
Xi Ruoyao <xry23333@gmail.com>
Xia Bin <snyh@snyh.org>
Xing Xing <mikespook@gmail.com>
Xu Fei <badgangkiller@gmail.com>
Xudong Zhang <felixmelon@gmail.com>
Xudong Zheng <7pkvm5aw@slicealias.com>
Xuyang Kang <xuyangkang@gmail.com>
Yamagishi Kazutoshi <ykzts@desire.sh>
Yan Zou <yzou@google.com>
Yang Tian <linuxty@gmail.com>
Yann Hodique <yhodique@google.com>
Yann Kerherv <yann.kerherve@gmail.com>
Yann Salan <yannsalaun1@gmail.com>
Yao Zhang <lunaria21@gmail.com>
Yaron de Leeuw <jarondl@google.com>
Yasha Bubnov <girokompass@gmail.com>
Yasser Abdolmaleki <yasser@yasser.ca>
Yasuharu Goto <matope.ono@gmail.com>
Yasuhiro Matsumoto <mattn.jp@gmail.com>
Yasuyuki Oka <yasuyk@gmail.com>
Yazen Shunnar <yazen.shunnar@gmail.com>
Yestin Sun <ylh@pdx.edu>
Yesudeep Mangalapilly <yesudeep@google.com>
Yissakhar Z. Beck <yissakhar.beck@gmail.com>
Yo-An Lin <yoanlin93@gmail.com>
Yohei Takeda <yo.tak0812@gmail.com>
Yongjian Xu <i3dmaster@gmail.com>
Yorman Arias <cixtords@gmail.com>

Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>
Yosuke Akatsuka <yosuke.akatsuka@gmail.com>
Yu Heng Zhang <annita.zhang@cn.ibm.com>
Yu Xuan Zhang <zyxsh@cn.ibm.com>
Yuji Yaginuma <yuuji.yaginuma@gmail.com>
Yuki OKUSHI <huyuumi.dev@gmail.com>
Yuki Yugui Sonoda <yugui@google.com>
Yukihiro Nishinaka <6elpinal@gmail.com>
Yury Smolsky <yury@smolsky.by>
Yusuke Kagiwada <block.rxckin.beats@gmail.com>
Yuusei Kuwana <kuwana@kumama.org>
Yuval Pavel Zholkover <paulzhol@gmail.com>
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>
Zac Bergquist <zbergquist99@gmail.com>
Zach Bintliff <zbintliff@gmail.com>
Zach Gershman <zachgersh@gmail.com>
Zach Jones <zachj1@gmail.com>
Zachary Amsden <zach@thundertoken.com>
Zachary Gershman <zgershman@pivotal.io>
Zak <zrjknill@gmail.com>
Zakatell Kanda <hi@zkanda.io>
Zellyn Hunter <zellyn@squareup.com> <zellyn@gmail.com>
Zev Goldstein <zev.goldstein@gmail.com>
Zheng Dayu <davidzheng23@gmail.com>
Zheng Xu <zheng.xu@arm.com>
Zhengyu He <hzy@google.com>
Zhongpeng Lin <zplin@uber.com>
Zhongtao Chen <chenzhongtao@126.com>
Zhongwei Yao <zhongwei.yao@arm.com>
Zhou Peng <p@ctruple.cn>
Ziad Hatahet <hatahet@gmail.com>
Zorion Arrizabalaga <zorionk@gmail.com>
<a.maksadbek@gmail.com>
<max.faceless.frei@gmail.com>
<hagen1778@gmail.com>
<tbunyk@gmail.com>
<faxriddinjon@gmail.com>
<zs349596@gmail.com>
<bronze1man@gmail.com>

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1.300 dom4j 2.1.3

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Found in path(s):

- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementQNameIterator.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementIterator.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/ElementHandler.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/CDATA.java
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- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/Action.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/Comment.java
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- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanDocumentFactory.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightCDATA.java
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- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/FilterIterator.java
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- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/Pattern.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/rule/Rule.java
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- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/NamespaceCache.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBObjectHandler.java
- * /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DOMReader.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyReader.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/dtd/AttributeDecl.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentInputSource.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/STAXEventReader.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/util/SingletonStrategy.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractDocumentType.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/DocumentException.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyException.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/util/UserDataDocumentFactory.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyContentHandler.java
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* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/util/AttributeHelper.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultText.java
* /opt/ws_local/PERMITS_SQL/1034543185_1588830303.8/0/dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultNamespace.java
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* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SQLErrorCodes.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/incrementer/PostgreSQLSequenceMaxValueIncrementer.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/OracleTableMetaDataProvider.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlReturnResultSet.java

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* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/incrementer/HsqlMaxValueIncrementer.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptException.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/UncategorizedScriptException.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/embedded/ConnectionProperties.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/incrementer/SqlServerMax ValueIncrementer.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/rowset/SqlRowSetMetaData.java
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jar/org/springframework/jdbc/support/rowset/ResultSetWrappingSqlRowSet.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/datasource/JdbcTransactionObjectSupport.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/datasource/LazyConnectionDataSourceProxy.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/support/KeyHolder.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/datasource/TransactionAwareDataSourceProxy.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/core/namedparam/SqlParameterSource.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/object/RdbmsOperation.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/core/namedparam/BeanPropertySqlParameterSource.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/core/simple/AbstractJdbcInsert.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/core/support/AbstractLobStreamingResultSetExtractor.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/support/rowset/SqlRowSet.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/support/CustomSQLExceptionTranslatorRegistry.java  
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/core/namedparam/MapSqlParameterSource.java
```

```
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/AbstractSqlParameterSource.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/init/ResourceDatabasePopulator.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/SQLStateSQLExceptionTranslator.java
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/object/SqlFunction.java
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```
*/
```

```
/**
```

```
* Implement this interface when parameters need to be customized based
```

```
* on the connection. We might need to do this to make use of proprietary
```

```
* features, available only with a specific Connection type.
```

```
*
```

```
* @author Rod Johnson
```

```
* @author Thomas Risberg
```

```
* @see CallableStatementCreatorFactory#newCallableStatementCreator(ParameterMapper)
```

```
* @see org.springframework.jdbc.object.StoredProcedure#execute(ParameterMapper)
```

```
*/
```

```
/**
```

```
* Create a Map of input parameters, keyed by name.
```

```
* @param con a JDBC connection. This is useful (and the purpose of this interface)
```

```
* if we need to do something RDBMS-specific with a proprietary Connection
```

```
* implementation class. This class conceals such proprietary details. However,
```

```
* it is best to avoid using such proprietary RDBMS features if possible.
```

```
* @return a Map of input parameters, keyed by name (never {@code null})
```

```
* @throws SQLException if an SQLException is encountered setting
```

```
* parameter values (that is, there's no need to catch SQLException)
```

```
*/
```

Found in path(s):

```
* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-
```

jar/org/springframework/jdbc/core/ParameterMapper.java

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* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/core/namedparam/MapSqlParameterSourceExtensions.kt

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jar/org/springframework/jdbc/support/incrementer/DB2MainFrameSequenceMaxValueIncrementer.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/incrementer/DB2SequenceMaxValueIncrementer.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/core/DisposableSqlTypeValue.java

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/xml/SqlXmlValue.java

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*/

/**

* Close this LobCreator session and free its temporarily created BLOBs and CLOBs.

* Will not need to do anything if using PreparedStatement's standard methods,

* but might be necessary to free database resources if using proprietary means.

* **NOTE**: Needs to be invoked after the involved PreparedStatements have

* been executed or the affected O/R mapping sessions have been flushed.

* Otherwise, the database resources for the temporary BLOBs might stay allocated.

*/

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* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/lob/LobCreator.java

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/**

* The classes in this package make JDBC easier to use and

* reduce the likelihood of common errors. In particular, they:

*

* - Simplify error handling, avoiding the need for try/catch/finally

* blocks in application code.

* - Present exceptions to application code in a generic hierarchy of

* unchecked exceptions, enabling applications to catch data access

* exceptions without being dependent on JDBC, and to ignore fatal

* exceptions there is no value in catching.

* - Allow the implementation of error handling to be modified

* to target different RDBMSes without introducing proprietary

* dependencies into application code.

*

*

*

This package and related packages are discussed in Chapter 9 of

* Expert One-On-One J2EE Design and Development

* by Rod Johnson (Wrox, 2002).

*/

Found in path(s):

* /opt/cola/permits/1301486295_1649248795.81/0/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/package-info.java

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1.303 Idns 1.7.1

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/* From openssh 4.3p2 filename openbsd-compat/fake-rfc2553.h */

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

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/*

* FILE: sha2.c

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

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

* - Renamed (external) functions and constants to fit Idns style
* - Removed _End and _Data functions
* - Added Idns_shaX(data, len, digest) convenience functions
* - Removed prototypes of _Transform functions and made those static
*
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*
* \$Id: sha2.c,v 1.1 2001/11/08 00:01:51 adg Exp adg \$
*/

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

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The following individuals contributed in part to the Network Time Protocol Distribution Version 4 and are acknowledged as authors of this work.

1. [1]Takao Abe <takao_abe@xurb.jp> Clock driver for JJY receivers
2. [2]Mark Andrews <mark_andrews@isc.org> Leitch atomic clock controller
3. [3]Bernd Altmeier <altmeier@atsoft.de> hopf Elektronik serial line and PCI-bus devices
4. [4]Viraj Bais <vbais@mailman1.intel.com> and [5]Clayton Kirkwood <kirkwood@striderfm.intel.com> port to WindowsNT 3.5
5. [6]Michael Barone <michael,barone@lmco.com> GPSVME fixes
6. [7]Karl Berry <karl@owl.HQ.ileaf.com> syslog to file option
7. [8]Greg Brackley <greg.brackley@bigfoot.com> Major rework of WINNT port. Clean up recvbuf and iosignal code into separate modules.
8. [9]Marc Brett <Marc.Brett@westgeo.com> Magnavox GPS clock driver
9. [10]Piete Brooks <Piete.Brooks@cl.cam.ac.uk> MSF clock driver, Trimble PARSE support
10. [11]Nelson B Bolyard <nelson@bolyard.me> update and complete broadcast and crypto features in sntp
11. [12]Jean-Francois Boudreault <Jean-Francois.Boudreault@viagenie.qc.ca> IPv6 support
12. [13]Reg Clemens <reg@dwf.com> Oncore driver (Current maintainer)
13. [14]Steve Clift <clift@ml.csiro.au> OMEGA clock driver
14. [15]Casey Crellin <casey@csc.co.za> vxWorks (Tornado) port and help with target configuration
15. [16]Sven Dietrich <sven_dietrich@trimble.com> Palisade reference clock driver, NT adj. residuals, integrated Greg's Winnt port.
16. [17]John A. Dundas III <dundas@salt.jpl.nasa.gov> Apple A/UX port
17. [18]Torsten Duwe <duwe@immd4.informatik.uni-erlangen.de> Linux port
18. [19]Dennis Ferguson <dennis@mrbill.canet.ca> foundation code for NTP Version 2 as specified in RFC-1119
19. [20]John Hay <jhay@icomtek.csir.co.za> IPv6 support and testing
20. [21]Dave Hart <davehart@davehart.com> General maintenance, Windows port interpolation rewrite
21. [22]Claas Hilbrecht <neoclock4x@linum.com> NeoClock4X clock driver
22. [23]Glenn Hollinger <glenn@herald.usask.ca> GOES clock driver
23. [24]Mike Iglesias <iglesias@uci.edu> DEC Alpha port
24. [25]Jim Jagielski <jim@jagubox.gsfc.nasa.gov> A/UX port
25. [26]Jeff Johnson <jbj@chatham.usdesign.com> massive prototyping overhaul
26. [27]Hans Lambermont <Hans.Lambermont@nl.origin-it.com> or [28]<H.Lambermont@chello.nl> ntpswep
27. [29]Poul-Henning Kamp <phk@FreeBSD.ORG> Oncore driver (Original author)
28. [30]Frank Kardel [31]<kardel (at) ntp (dot) org> PARSE <GENERIC>

- (driver 14 reference clocks), STREAMS modules for PARSE, support scripts, syslog cleanup, dynamic interface handling
29. [32]Johannes Maximilian Kuehn <kuehn@ntp.org> Rewrote sntp to comply with NTPv4 specification, ntpq saveconfig
 30. [33]William L. Jones <jones@hermes.chpc.utexas.edu> RS/6000 AIX modifications, HPUX modifications
 31. [34]Dave Katz <dkatz@cisco.com> RS/6000 AIX port
 32. [35]Craig Leres <leres@ee.lbl.gov> 4.4BSD port, ppsclock, Magnavox GPS clock driver
 33. [36]George Lindholm <lindholm@ucs.ubc.ca> SunOS 5.1 port
 34. [37]Louis A. Mamakos <louie@ni.umd.edu> MD5-based authentication
 35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation code for Version 3 as specified in RFC-1305
 36. [39]Danny Mayer <mayer@ntp.org>Network I/O, Windows Port, Code Maintenance
 37. [40]David L. Mills <mills@udel.edu> Version 4 foundation, precision kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36
 38. [41]Wolfgang Moeller <moeller@gwdgv1.dnet.gwdg.de> VMS port
 39. [42]Jeffrey Mogul <mogul@pa.dec.com> ntptrace utility
 40. [43]Tom Moore <tmoore@fievel.daytonoh.ncr.com> i386 svr4 port
 41. [44]Kamal A Mostafa <kamal@whence.com> SCO OpenServer port
 42. [45]Derek Mulcahy <derek@toybox.demon.co.uk> and [46]Damon Hart-Davis <d@hd.org> ARCRON MSF clock driver
 43. [47]Rob Neal <neal@ntp.org> Bancomm refclock and config/parse code maintenance
 44. [48]Rainer Pruy <Rainer.Pruy@informatik.uni-erlangen.de> monitoring/trap scripts, statistics file handling
 45. [49]Dirce Richards <dirce@zk3.dec.com> Digital UNIX V4.0 port
 46. [50]Wilfredo Snchez <wsanchez@apple.com> added support for NetInfo
 47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
 48. [52]Jack Sasportas <jack@innovativeinternet.com> Saved a Lot of space on the stuff in the html/pic/ subdirectory
 49. [53]Ray Schnitzler <schnitz@unipress.com> Unixware1 port
 50. [54]Michael Shields <shields@tembel.org> USNO clock driver
 51. [55]Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
 52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
 53. [57]Kenneth Stone <ken@sdd.hp.com> HP-UX port
 54. [58]Ajit Thyagarajan <ajit@ee.udel.edu>IP multicast/anycast support
 55. [59]Tomoaki TSURUOKA <tsuruoka@nc.fukuoka-u.ac.jp>TRAK clock driver
 56. [60]Brian Utterback <brian.utterback@oracle.com> General codebase, Solaris issues
 57. [61]Loganaden Velvindron <loganaden@gmail.com> Sandboxing (libseccomp) support
 58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic TrueTime clock driver
 59. [63]Ulrich Windl <Ulrich.Windl@rz.uni-regensburg.de> corrected and validated HTML documents according to the HTML DTD

References

1. mailto:%20takao_abe@xurb.jp
2. mailto:%20mark_andrews@isc.org
3. <mailto:%20altmeier@atlsoft.de>
4. <mailto:%20vbais@mailman1.intel.co>
5. <mailto:%20kirkwood@striderfm.intel.com>
6. <mailto:%20michael.barone@lmco.com>
7. <mailto:%20karl@owl.HQ.ileaf.com>
8. <mailto:%20greg.brackley@bigfoot.com>
9. <mailto:%20Marc.Brett@westgeo.com>
10. <mailto:%20Piete.Brooks@cl.cam.ac.uk>
11. <mailto:%20nelson@bolyard.me>
12. <mailto:%20Jean-Francois.Boudreault@viagenie.qc.ca>
13. <mailto:%20reg@dwf.com>
14. <mailto:%20clift@ml.csiro.au>
15. <mailto:%20casey@csc.co.za>
16. mailto:%20Sven_Dietrich@trimble.COM
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18. <mailto:%20duwe@immd4.informatik.uni-erlangen.de>
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36. <mailto:%20lindholm@ucs.ubc.ca>
37. <mailto:%20louie@ni.umd.edu>
38. <mailto:%20thorinn@diku.dk>
39. <mailto:%20mayer@ntp.org>
40. <mailto:%20mills@udel.edu>
41. <mailto:%20moeller@gwdgv1.dnet.gwdg.de>
42. <mailto:%20mogul@pa.dec.com>
43. <mailto:%20tmoore@fivel.daytonoh.ncr.com>
44. <mailto:%20kamal@whence.com>

45. mailto:%20derek@toybox.demon.co.uk
46. mailto:%20d@hd.org
47. mailto:%20neal@ntp.org
48. mailto:%20Rainer.Pruy@informatik.uni-erlangen.de
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50. mailto:%20wsanchez@apple.com
51. mailto:%20mrapple@quack.kfu.com
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59. mailto:%20tsuruoka@nc.fukuoka-u.ac.jp
60. mailto:%20brian.utterback@oracle.com
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1.308 nio-stream-storage 1.1.3

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1.310 cyrus-sasl 2.1.27+dfsg-2ubuntu0.1

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 * Rob Earhart
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```
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/adapter/ForwardedHeaderTransformer.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/bind/annotation/RestControllerAdvice.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/ContentCachingResponseWrapper.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/client/HttpServerErrorException.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/MultipartBodyBuilder.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/accept/FixedContentNegotiationStrategy.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/xml/Jaxb2XmlEncoder.java
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jar/org/springframework/web/filter/AbstractRequestLoggingFilter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/multipart/support/MultipartResolutionDelegate.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
```

jar/org/springframework/web/server/handler/DefaultWebFilterChain.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/AbstractListenerReadPublisher.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/adapters/DefaultServerWebExchange.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/SimpleClientHttpResponse.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/filter/CorsFilter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/client/UnknownHttpStatusCodeException.java
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jar/org/springframework/http/codec/protobuf/ProtobufEncoder.java
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jar/org/springframework/web/util/HtmlCharacterEntityDecoder.java
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jar/org/springframework/web/server/handler/WebHandlerDecorator.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/CacheControl.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/ContextCleanupListener.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/xml/XmlEventDecoder.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/session/InMemoryWebSessionStore.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/request/ServletRequestAttributes.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/client/RestOperations.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/xml/MappingJackson2XmlHttpMessageConverter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/support/RequestHandledEvent.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-

jar/org/springframework/http/client/ClientHttpRequestInitializer.java
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jar/org/springframework/http/client/support/BasicAuthenticationInterceptor.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/ServerCodecConfigurer.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/json/Jackson2SmileEncoder.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/cors/UrlBasedCorsConfigurationSource.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/feed/AbstractWireFeedHttpMessageConverter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/pattern/InternalPathPatternParser.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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jar/org/springframework/http/client/OkHttp3ClientHttpRequestFactory.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/filter/OncePerRequestFilter.java
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jar/org/springframework/web/client/RestClientResponseException.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/ByteArrayHttpMessageConverter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/support/ServletContextScope.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/filter/reactive/ServerWebExchangeContextFilter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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jar/org/springframework/http/HttpStatus.java
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jar/org/springframework/http/HttpRange.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/support/ClientDefaultCodecsImpl.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/xml/JaxbContextContainer.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/filter/reactive/ForwardedHeaderFilter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/AbstractServerHttpRequest.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/xml/SourceHttpMessageConverter.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/support/ServerDefaultCodecsImpl.java
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jar/org/springframework/http/server/ServerHttpRequest.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/support/DefaultServerCodecConfigurer.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/client/RestOperationsExtensions.kt
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/annotation/AbstractWebArgumentResolverAdapter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/support/DefaultClientCodecConfigurer.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/BufferedImageHttpMessageConverter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-

jar/org/springframework/web/server/ServerWebExchangeDecorator.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/reactive/ClientHttpResponse.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/FormHttpMessageWriter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/accept/MediaTypeFileExtensionResolver.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/support/HttpAccessor.java
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*/
```

Found in path(s):

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/support/ServletContextResourceLoader.java
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* limitations under the License.  
*/
```

Found in path(s):

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/ServletContextRequestLoggingFilter.java

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

```
# This file maps Internet media types to unique file extension(s).
# Although created for httpd, this file is used by many software systems
# and has been placed in the public domain for unlimited redistribution.
#
# The table below contains both registered and (common) unregistered types.
# A type that has no unique extension can be ignored -- they are listed
# here to guide configurations toward known types and to make it easier to
# identify "new" types. File extensions are also commonly used to indicate
# content languages and encodings, so choose them carefully.
#
# Internet media types should be registered as described in RFC 4288.
# The registry is at <https://www.iana.org/assignments/media-types/>.
#
# This file was retrieved from
https://svn.apache.org/viewvc/httpd/httpd/trunk/docs/conf/mime.types?revision=1752884&view=co
#
# MIME type (lowercased) Extensions
# =====
# application/1d-interleaved-parityfec
# application/3gpdash-qoe-report+xml
# application/3gpp-ims+xml
# application/a2l
# application/activemessage
# application/alto-costmap+json
# application/alto-costmapfilter+json
# application/alto-directory+json
# application/alto-endpointcost+json
# application/alto-endpointcostparams+json
# application/alto-endpointprop+json
# application/alto-endpointpropparams+json
# application/alto-error+json
# application/alto-networkmap+json
# application/alto-networkmapfilter+json
# application/aml
application/andrew-inset ez
# application/applefile
application/applixware aw
# application/atf
# application/atfx
application/atom+xml atom
application/atomcat+xml atomcat
# application/atomdeleted+xml
# application/atomicmail
```

application/atomsvc+xml atomsvc
application/atxml
application/auth-policy+xml
application/bacnet-xdd+zip
application/batch-smtp
application/beep+xml
application/calendar+json
application/calendar+xml
application/call-completion
application/cals-1840
application/cbor
application/ccmp+xml
application/ccxml+xml ccxml
application/cdfx+xml
application/cdmi-capability cdmia
application/cdmi-container cdmic
application/cdmi-domain cdmid
application/cdmi-object cdmio
application/cdmi-queue cdmiq
application/cdni
application/cea
application/cea-2018+xml
application/cellml+xml
application/cfw
application/cms
application/cnrx+xml
application/coap-group+json
application/commonground
application/conference-info+xml
application/cpl+xml
application/csrattrs
application/csta+xml
application/cstadata+xml
application/csvm+json
application/cu-seeme cu
application/cybercash
application/dash+xml
application/dashdelta
application/davmount+xml davmount
application/dca-rft
application/dcd
application/dec-dx
application/dialog-info+xml
application/dicom
application/dii
application/dit
application/dns
application/docbook+xml dbk

application/dskpp+xml
application/dssc+der dssc
application/dssc+xml xdssc
application/dvcs
application/ecmascript ecma
application/edi-consent
application/edi-x12
application/edifact
application/efi
application/emergencycalldata.comment+xml
application/emergencycalldata.deviceinfo+xml
application/emergencycalldata.providerinfo+xml
application/emergencycalldata.serviceinfo+xml
application/emergencycalldata.subscriberinfo+xml
application/emma+xml emma
application/emotionml+xml
application/encaprtsp
application/epp+xml
application/epub+zip epub
application/eshop
application/example
application/exi exi
application/fastinfoset
application/fastsoap
application/fdt+xml
application/fits
application/font-sfnt
application/font-tdpfr pfr
application/font-woff woff
application/framework-attributes+xml
application/geo+json
application/gml+xml gml
application/gpx+xml gpx
application/gxf gxf
application/gzip
application/h224
application/held+xml
application/http
application/hyperstudio stk
application/ibe-key-request+xml
application/ibe-pkg-reply+xml
application/ibe-pp-data
application/iges
application/im-iscomposing+xml
application/index
application/index.cmd
application/index.obj
application/index.response

application/index.vnd
application/inkml+xml ink inkml
application/iotp
application/ipfix ipfix
application/ipp
application/isup
application/its+xml
application/java-archive jar
application/java-serialized-object ser
application/java-vm class
application/javascript js
application/jose
application/jose+json
application/jrd+json
application/json json
application/json-patch+json
application/json-seq
application/jsonml+json jsonml
application/jwk+json
application/jwk-set+json
application/jwt
application/kpml-request+xml
application/kpml-response+xml
application/ld+json
application/lgr+xml
application/link-format
application/load-control+xml
application/lost+xml lostxml
application/lostsync+xml
application/lxf
application/mac-binhex40 hqx
application/mac-compactpro cpt
application/macwriteii
application/mads+xml mads
application/marc mrc
application/marcxml+xml mrcx
application/mathematica ma nb mb
application/mathml+xml mathml
application/mathml-content+xml
application/mathml-presentation+xml
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application/mbms-deregister+xml
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application/mbms-schedule+xml
application/mbms-user-service-description+xml
application/mbox mbox
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application/mf4
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application/mods+xml mods
application/moss-keys
application/moss-signature
application/mosskey-data
application/mosskey-request
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application/mp4 mp4s
application/mpeg4-generic
application/mpeg4-iod
application/mpeg4-iod-xmt
application/mrb-consumer+xml
application/mrb-publish+xml
application/msc-ivr+xml
application/msc-mixer+xml
application/msword doc dot
application/mxf mxf
application/nasdata
application/news-checkgroups
application/news-groupinfo
application/news-transmission
application/nlsml+xml
application/nss
application/ocsp-request
application/ocsp-response
application/octet-stream bin dms lrf mar so dist distz pkg bpk dump elc deploy
application/oda oda
application/odx
application/oebps-package+xml opf
application/ogg ogg
application/omdoc+xml omdoc
application/onenote onetoc onetoc2 onetmp onepkg
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application/patch-ops-error+xml xer

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application/pkcs7-signature p7s
application/pkcs8 p8
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application/pkix-crl crl
application/pkix-pkipath pkipath
application/pkixcmp pki
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application/provenance+xml
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application/prs.cww cww
application/prs.hpub+zip
application/prs.nprend
application/prs.plucker
application/prs.rdf-xml-crypt
application/prs.xsf+xml
application/pskc+xml pskcxml
application/qsig
application/raptorfec
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application/rdf+xml rdf
application/reginfo+xml rif
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application/rfc+xml
application/riscos
application/rlmi+xml
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application/rpki-manifest mft
application/rpki-roa roa
application/rpki-updown
application/rsd+xml rsd
application/rss+xml rss
application/rtf rtf
application/rtploopback
application/rtx
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application/samlmetadata+xml
application/sbml+xml sbml
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application/sep-exi
application/session-info
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application/set-registration
application/set-registration-initiation setreg
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application/sgml-open-catalog
application/shf+xml shf
application/sieve
application/simple-filter+xml
application/simple-message-summary
application/simplesymbolcontainer
application/slate
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application/smil+xml smi smil
application/smpite336m
application/soap+fastinfoset
application/soap+xml
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application/timestamp-reply
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application/vividence.scriptfile
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application/vnd.3gpp.pic-bw-small psb
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application/vnd.3gpp2.bcmcsinfo+xml
application/vnd.3gpp2.sms
application/vnd.3gpp2.tcap tcap
application/vnd.3lightssoftware.imagescal
application/vnd.3m.post-it-notes pwn
application/vnd.accpac.simply.aso aso
application/vnd.accpac.simply.imp imp
application/vnd.acucobol acu

application/vnd.acucorp atc acute
application/vnd.adobe.air-application-installer-package+zip air
application/vnd.adobe.flash.movie
application/vnd.adobe.formscentral.fcdt fcdt
application/vnd.adobe.fxp fxp fxpl
application/vnd.adobe.partial-upload
application/vnd.adobe.xdp+xml xdp
application/vnd.adobe.xfdf xfdf
application/vnd.aether.imp
application/vnd.ah-barcode
application/vnd.ahead.space ahead
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application/vnd.amazon.mobi8-ebook
application/vnd.americandynamics.acc acc
application/vnd.amiga.ami ami
application/vnd.amundsen.maze+xml
application/vnd.android.package-archive apk
application/vnd.anki
application/vnd.anser-web-certificate-issue-initiation cii
application/vnd.anser-web-funds-transfer-initiation fti
application/vnd.antix.game-component atx
application/vnd.apache.thrift.binary
application/vnd.apache.thrift.compact
application/vnd.apache.thrift.json
application/vnd.api+json
application/vnd.apple.installer+xml mpkg
application/vnd.apple.mpegurl m3u8
application/vnd.arastra.swi
application/vnd.aristanetworks.swi swi
application/vnd.artsquare
application/vnd.astraea-software.iota iota
application/vnd.audiograph aep
application/vnd.autopackage
application/vnd.avistar+xml
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application/vnd.balsamiq.bmpr
application/vnd.bekitzur-stech+json
application/vnd.biopax.rdf+xml
application/vnd.blueice.multipass mpm
application/vnd.bluetooth.ep.oob
application/vnd.bluetooth.le.oob
application/vnd.bmi bmi
application/vnd.businessobjects rep
application/vnd.cab-jscript
application/vnd.canon-cpdl
application/vnd.canon-lips

```
# application/vnd.cendio.thinlinc.clientconf
# application/vnd.century-systems.tcp_stream
application/vnd.chemdraw+xml cdxml
# application/vnd.chess-pgn
application/vnd.chipnuts.karaoke-mmd mmd
application/vnd.cinderella cdy
# application/vnd.cirpack.isdn-ext
# application/vnd.citationstyles.style+xml
application/vnd.claymore cla
application/vnd.cloanto.rp9 rp9
application/vnd.clonk.c4group c4g c4d c4f c4p c4u
application/vnd.cluetrust.cartomobile-config c11amc
application/vnd.cluetrust.cartomobile-config-pkg c11amz
# application/vnd.coffeescript
# application/vnd.collection+json
# application/vnd.collection.doc+json
# application/vnd.collection.next+json
# application/vnd.comicbook+zip
# application/vnd.commerce-battelle
application/vnd.commonspace csp
application/vnd.contact.cmsg cdbcmsg
# application/vnd.coreos.ignition+json
application/vnd.cosmocaller cmc
application/vnd.crick.clicker clkx
application/vnd.crick.clicker.keyboard clkk
application/vnd.crick.clicker.palette clkp
application/vnd.crick.clicker.template clkt
application/vnd.crick.clicker.wordbank clkw
application/vnd.criticaltools.wbs+xml wbs
application/vnd.ctc-posml pml
# application/vnd.ctct.ws+xml
# application/vnd.cups-pdf
# application/vnd.cups-postscript
application/vnd.cups-ppd ppd
# application/vnd.cups-raster
# application/vnd.cups-raw
# application/vnd.curl
application/vnd.curl.car car
application/vnd.curl.pcurl pcurl
# application/vnd.cyan.dean.root+xml
# application/vnd.cybank
application/vnd.dart dart
application/vnd.data-vision.rdz rdz
# application/vnd.debian.binary-package
application/vnd.dece.data uvf uvvf uvd uvvd
application/vnd.dece.ttml+xml uvt uvvt
application/vnd.dece.unspecified uvx uvvx
application/vnd.dece.zip uvz uvvz
```

application/vnd.denovo.fcselayout-link fe_launch
application/vnd.desmume.movie
application/vnd.dir-bi.plate-dl-nosuffix
application/vnd.dm.delegation+xml
application/vnd.dna dna
application/vnd.document+json
application/vnd.dolby.mlp mlp
application/vnd.dolby.mobile.1
application/vnd.dolby.mobile.2
application/vnd.doremir.scorecloud-binary-document
application/vnd.dpgraph dpg
application/vnd.dreamfactory dfac
application/vnd.drive+json
application/vnd.ds-keypoint kpxx
application/vnd.dtg.local
application/vnd.dtg.local.flash
application/vnd.dtg.local.html
application/vnd.dvb.ait ait
application/vnd.dvb.dvbj
application/vnd.dvb.esgcontainer
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application/vnd.dvb.ipdcesgaccess
application/vnd.dvb.ipdcesgaccess2
application/vnd.dvb.ipdcesgpdd
application/vnd.dvb.ipdcroaming
application/vnd.dvb.iptv.alfec-base
application/vnd.dvb.iptv.alfec-enhancement
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application/vnd.dvb.notif-container+xml
application/vnd.dvb.notif-generic+xml
application/vnd.dvb.notif-ia-msglist+xml
application/vnd.dvb.notif-ia-registration-request+xml
application/vnd.dvb.notif-ia-registration-response+xml
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application/vnd.dvb.pfr
application/vnd.dvb.service svc
application/vnd.dxr
application/vnd.dynageo geo
application/vnd.dzr
application/vnd.easykaraoke.cdgdownload
application/vnd.ecdis-update
application/vnd.ecowin.chart mag
application/vnd.ecowin.filerequest
application/vnd.ecowin.fileupdate
application/vnd.ecowin.series
application/vnd.ecowin.seriesrequest
application/vnd.ecowin.seriesupdate
application/vnd.emclient.accessrequest+xml

application/vnd.enliven nml
application/vnd.enphase.envoy
application/vnd.eprints.data+xml
application/vnd.epson.esf esf
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application/vnd.epson.quickanime qam
application/vnd.epson.salt slt
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application/vnd.etsi.asic-s+zip
application/vnd.etsi.cug+xml
application/vnd.etsi.iptvcommand+xml
application/vnd.etsi.iptvdiscovery+xml
application/vnd.etsi.iptvprofile+xml
application/vnd.etsi.iptvsad-bc+xml
application/vnd.etsi.iptvsad-cod+xml
application/vnd.etsi.iptvsad-npvr+xml
application/vnd.etsi.iptvservice+xml
application/vnd.etsi.iptvsync+xml
application/vnd.etsi.iptvueprofile+xml
application/vnd.etsi.mcid+xml
application/vnd.etsi.mheg5
application/vnd.etsi.overload-control-policy-dataset+xml
application/vnd.etsi.pstn+xml
application/vnd.etsi.sci+xml
application/vnd.etsi.simservs+xml
application/vnd.etsi.timestamp-token
application/vnd.etsi.tsl+xml
application/vnd.etsi.tsl.der
application/vnd.eudora.data
application/vnd.ezpix-album ez2
application/vnd.ezpix-package ez3
application/vnd.f-secure.mobile
application/vnd.fastcopy-disk-image
application/vnd.fdf fdf
application/vnd.fdsn.mseed mseed
application/vnd.fdsn.seed seed dataless
application/vnd.ffmpeg
application/vnd.filmit.zfc
application/vnd.fints
application/vnd.firemonkeys.cloudcell
application/vnd.flographit gph
application/vnd.fluxtime.clip ftc
application/vnd.font-fontforge-sfd
application/vnd.frame-maker fm frame maker book

application/vnd.frogans.fnc fnc
application/vnd.frogans.ltf ltf
application/vnd.fsc.weblaunch fsc
application/vnd.fujitsu.oasys oas
application/vnd.fujitsu.oasys2 oa2
application/vnd.fujitsu.oasys3 oa3
application/vnd.fujitsu.oasysgp fg5
application/vnd.fujitsu.oasysprs bh2
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application/vnd.fujixerox.art4
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application/vnd.fujixerox.docuworks xdw
application/vnd.fujixerox.docuworks.binder xbd
application/vnd.fujixerox.docuworks.container
application/vnd.fujixerox.hbpl
application/vnd.fut-misnet
application/vnd.fuzzysheet fzs
application/vnd.genomatix.tuxedo txd
application/vnd.geo+json
application/vnd.geocube+xml
application/vnd.geogebra.file ggb
application/vnd.geogebra.tool ggt
application/vnd.geometry-explorer gex gre
application/vnd.geonext gxt
application/vnd.geoplan g2w
application/vnd.geospace g3w
application/vnd.gerber
application/vnd.globalplatform.card-content-mgt
application/vnd.globalplatform.card-content-mgt-response
application/vnd.gmx gmx
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application/vnd.google-earth.kmz kmz
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application/vnd.gov.sk.xmldatacontainer+xml
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application/vnd.gridmp
application/vnd.groove-account gac
application/vnd.groove-help ghf
application/vnd.groove-identity-message gim
application/vnd.groove-injector grv
application/vnd.groove-tool-message gtm
application/vnd.groove-tool-template tpl
application/vnd.groove-vcard vcg
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application/vnd.hal+xml hal
application/vnd.handheld-entertainment+xml zmm
application/vnd.hbci hbci

application/vnd.hcl-bireports
application/vnd.hdt
application/vnd.heroku+json
application/vnd.hhe.lesson-player les
application/vnd.hp-hpgl hpgl
application/vnd.hp-hpid hpid
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application/vnd.hyperdrive+json
application/vnd.hzn-3d-crossword
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application/vnd.ibm.electronic-media
application/vnd.ibm.minipay mpy
application/vnd.ibm.modcap afp listafp list3820
application/vnd.ibm.rights-management irm
application/vnd.ibm.secure-container sc
application/vnd.iccprofile icc icm
application/vnd.ieee.1905
application/vnd.igloader igl
application/vnd.immervision-ivp ivp
application/vnd.immervision-ivu ivu
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application/vnd.ims.imsccv1p3
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application/vnd.ims.lti.v2.toolproxy+json
application/vnd.ims.lti.v2.toolproxy.id+json
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application/vnd.informix-visionary
application/vnd.infotech.project
application/vnd.infotech.project+xml
application/vnd.innopath.wamp.notification
application/vnd.insors.igm igm
application/vnd.intercon.formnet xpw xpx
application/vnd.intergeo i2g
application/vnd.intertrust.digibox
application/vnd.intertrust.nncp
application/vnd.intu.qbo qbo
application/vnd.intu.qfx qfx
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application/vnd.iptc.g2.packageitem+xml
application/vnd.iptc.g2.planningitem+xml
application/vnd.ipunplugged.rcprofile rcprofile
application/vnd.irepository.package+xml irp
application/vnd.is-xpr xpr
application/vnd.isac.fcs fcs
application/vnd.jam jam
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application/vnd.japannet-payment-wakeup
application/vnd.japannet-registration
application/vnd.japannet-registration-wakeup
application/vnd.japannet-setstore-wakeup
application/vnd.japannet-verification
application/vnd.japannet-verification-wakeup
application/vnd.jcp.javame.midlet-rms rms
application/vnd.jisp jisp
application/vnd.joost.joda-archive joda
application/vnd.jsk.isdn-ngn
application/vnd.kahootz ktz ktr
application/vnd.kde.karbon karbon
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application/vnd.kde.kformula kfo
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application/vnd.kde.kspread ksp
application/vnd.kde.kword kwd kwt
application/vnd.kenameaapp htke
application/vnd.kidspiration kia
application/vnd.kinar kne knp
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application/vnd.liberty-request+xml
application/vnd.llamagraphics.life-balance.desktop lbd
application/vnd.llamagraphics.life-balance.exchange+xml lbe
application/vnd.lotus-1-2-3 123
application/vnd.lotus-approach apr
application/vnd.lotus-freelance pre
application/vnd.lotus-notes nsf
application/vnd.lotus-organizer org
application/vnd.lotus-screencam scm
application/vnd.lotus-wordpro lwp
application/vnd.macports.portpkg portpkg

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# application/vnd.mapbox-vector-tile
# application/vnd.marlin.drm.actiontoken+xml
# application/vnd.marlin.drm.conftoken+xml
# application/vnd.marlin.drm.license+xml
# application/vnd.marlin.drm.mdcf
# application/vnd.mason+json
# application/vnd.maxmind.maxmind-db
application/vnd.mcd mcd
application/vnd.medcalldata mc1
application/vnd.mediatation.cdkey cdkey
# application/vnd.meridian-slideshow
application/vnd.mfer mwf
application/vnd.mfmp mfm
# application/vnd.micro+json
application/vnd.micrografx.flo flo
application/vnd.micrografx.igx igx
# application/vnd.microsoft.portable-executable
# application/vnd.miele+json
application/vnd.mif mif
# application/vnd.minisoft-hp3000-save
# application/vnd.mitsubishi.misty-guard.trustweb
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application/vnd.mobius.dis dis
application/vnd.mobius.mbk mbk
application/vnd.mobius.mqy mqy
application/vnd.mobius.msl msl
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application/vnd.mobius.txf txf
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application/vnd.mophun.certificate mpc
# application/vnd.motorola.flexsuite
# application/vnd.motorola.flexsuite.adi
# application/vnd.motorola.flexsuite.fis
# application/vnd.motorola.flexsuite.gotap
# application/vnd.motorola.flexsuite.kmr
# application/vnd.motorola.flexsuite.ttc
# application/vnd.motorola.flexsuite.wem
# application/vnd.motorola.iprm
application/vnd.mozilla.xul+xml xul
# application/vnd.ms-3mfdocument
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# application/vnd.ms-asf
application/vnd.ms-cab-compressed cab
# application/vnd.ms-color.iccprofile
application/vnd.ms-excel xls xlm xla xlc xlt xlw
application/vnd.ms-excel.addin.macroenabled.12 xlam
application/vnd.ms-excel.sheet.binary.macroenabled.12 xlsb
application/vnd.ms-excel.sheet.macroenabled.12 xlsm
```

application/vnd.ms-excel.template.macroenabled.12 xltm
application/vnd.ms-fontobject eot
application/vnd.ms-htmlhelp chm
application/vnd.ms-ims ims
application/vnd.ms-lrm lrm
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application/vnd.ms-officetheme thmx
application/vnd.ms-opentype
application/vnd.ms-package.obfuscated-opentype
application/vnd.ms-pki.seccat cat
application/vnd.ms-pki.stl stl
application/vnd.ms-playready.initiator+xml
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application/vnd.ms-project mpp mpt
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application/vnd.ms-windows.wsd.oob
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application/vnd.ms-wmdrm.meter-resp
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application/vnd.ms-word.template.macroenabled.12 dotm
application/vnd.ms-works wps wks wcm wdb
application/vnd.ms-wpl wpl
application/vnd.ms-xpsdocument xps
application/vnd.msa-disk-image
application/vnd.mseq mseq
application/vnd.msign
application/vnd.multiad.creator
application/vnd.multiad.creator.cif
application/vnd.music-niff
application/vnd.musician mus
application/vnd.muvee.style msty
application/vnd.mynfc taglet
application/vnd.ncd.control
application/vnd.ncd.reference
application/vnd.nervana

```
# application/vnd.netfpx
application/vnd.neurolanguage.nlu nlu
# application/vnd.nintendo.nitro.rom
# application/vnd.nintendo.snes.rom
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application/vnd.noblenet-sealer nns
application/vnd.noblenet-web nnw
# application/vnd.nokia.catalogs
# application/vnd.nokia.conml+wxml
# application/vnd.nokia.conml+xml
# application/vnd.nokia.ipvt.config+xml
# application/vnd.nokia.isds-radio-presets
# application/vnd.nokia.landmark+wxml
# application/vnd.nokia.landmark+xml
# application/vnd.nokia.landmarkcollection+xml
# application/vnd.nokia.n-gage.ac+xml
application/vnd.nokia.n-gage.data ngdat
application/vnd.nokia.n-gage.symbian.install n-gage
# application/vnd.nokia.ncd
# application/vnd.nokia.pcd+wxml
# application/vnd.nokia.pcd+xml
application/vnd.nokia.radio-preset rpst
application/vnd.nokia.radio-presets rpss
application/vnd.novadigm.edm edm
application/vnd.novadigm.edx edx
application/vnd.novadigm.ext ext
# application/vnd.ntt-local.content-share
# application/vnd.ntt-local.file-transfer
# application/vnd.ntt-local.ogw_remote-access
# application/vnd.ntt-local.sip-ta_remote
# application/vnd.ntt-local.sip-ta_tcp_stream
application/vnd.oasis.opendocument.chart odc
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application/vnd.oasis.opendocument.formula odf
application/vnd.oasis.opendocument.formula-template odft
application/vnd.oasis.opendocument.graphics odg
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application/vnd.oasis.opendocument.image-template oti
application/vnd.oasis.opendocument.presentation odp
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application/vnd.oasis.opendocument.spreadsheet-template ots
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application/vnd.oasis.opendocument.text-master odm
application/vnd.oasis.opendocument.text-template ott
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application/vnd.oasis.opendocument.text-web oth
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application/vnd.oipf.pae.gem
application/vnd.oipf.spdiscovery+xml
application/vnd.oipf.spdlist+xml
application/vnd.oipf.ueprofile+xml
application/vnd.oipf.userprofile+xml
application/vnd.olpc-sugar xo
application/vnd.oma-scws-config
application/vnd.oma-scws-http-request
application/vnd.oma-scws-http-response
application/vnd.oma.bcast.associated-procedure-parameter+xml
application/vnd.oma.bcast.drm-trigger+xml
application/vnd.oma.bcast.imd+xml
application/vnd.oma.bcast.ltkm
application/vnd.oma.bcast.notification+xml
application/vnd.oma.bcast.provisioningtrigger
application/vnd.oma.bcast.sgboot
application/vnd.oma.bcast.sgdd+xml
application/vnd.oma.bcast.sgdu
application/vnd.oma.bcast.simple-symbol-container
application/vnd.oma.bcast.smartcard-trigger+xml
application/vnd.oma.bcast.sprov+xml
application/vnd.oma.bcast.stkm
application/vnd.oma.cab-address-book+xml
application/vnd.oma.cab-feature-handler+xml
application/vnd.oma.cab-pcc+xml
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application/vnd.oma.dcdc
application/vnd.oma.dd2+xml dd2
application/vnd.oma.drm.risd+xml
application/vnd.oma.group-usage-list+xml
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application/vnd.oma.lwm2m+tlv
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application/vnd.openofficeorg.extension oxt
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# message/disposition-notification
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# message/external-body
# message/feedback-report
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# message/global-headers
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# message/partial
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x-conference/x-cooltalk ice

Found in path(s):

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- * /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/util/HierarchicalUriComponents.java
- * /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/ContentNegotiationManagerFactoryBean.java
- * /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ServletServerHttpResponse.java
- * /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/reactive/DefaultCorsProcessor.java
- * /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpHeaders.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ServletContextAware.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/multipart/support/StandardMultipartHttpServletRequest.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/JettyHttpHandlerAdapter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/ContextPathCompositeHandler.java
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 */  
/**  
 * Return the web session for the current request. Always guaranteed to  
 * return an instance either matching to the session id requested by the  
 * client, or with a new session id either because the client did not  
 * specify one or because the underlying session had expired. Use of this  
 * method does not automatically create a session. See {@link WebSession}  
 * for more details.  
 */
```

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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/server/ServerWebExchange.java

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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/pattern/LiteralPathElement.java
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jar/org/springframework/http/ResponseEntity.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/pattern/CaptureTheRestPathElement.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/bind/annotation/CookieValue.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/MediaTypeFactory.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/pattern/SingleCharWildcardedPathElement.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/UriComponents.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/handler/ResponseStatusExceptionHandler.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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jar/org/springframework/web/client/DefaultResponseErrorHandler.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/annotation/ModelAttributeMethodProcessor.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/adapter/HttpWebHandlerAdapter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/util/UriComponentsBuilder.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/bind/support/WebExchangeDataBinder.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/ResponseStatus.java

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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/DefaultSessionAttributeStore.java

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/async/DeferredResultProcessingInterceptorAdapter.java

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/remoting/jaxws/JaxWsPortClientInterceptor.java

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/remoting/httpinvoker/HttpInvokerProxyFactoryBean.java

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/support/InterceptingAsyncHttpAccessor.java

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/Netty4ClientHttpResponse.java

* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/NativeWebRequest.java

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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/AsyncClientHttpRequestFactory.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/multipart/MultipartException.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/json/GsonFactoryBean.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/remoting/jaxws/JaxWsPortProxyFactoryBean.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/server/RequestPath.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/ServletContextAwareProcessor.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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jar/org/springframework/web/filter/DelegatingFilterProxy.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/feed/RssChannelHttpMessageConverter.java
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jar/org/springframework/http/HttpMessage.java
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jar/org/springframework/web/server/WebFilterChain.java
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jar/org/springframework/web/bind/annotation/SessionAttributes.java
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jar/org/springframework/web/util/HttpSessionMutexListener.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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jar/org/springframework/web/bind/support/SpringWebConstraintValidatorFactory.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/WebFilter.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/HttpMessageNotWritableException.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/HttpMessageConversionException.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/AbstractClientHttpRequestFactoryWrapper.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/DestructionCallbackBindingListener.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ConfigurableWebApplicationContext.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/AbstractClientHttpRequest.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/ServletConfigPropertySource.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/ClientHttpRequest.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/server/ServerHttpAsyncRequestControl.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/ServletContextPropertySource.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/PostMapping.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/ReactiveHttpOutputMessage.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/server/session/WebSessionIdResolver.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/ServletContextLiveBeansView.java
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/WebExceptionHandler.java
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jar/org/springframework/remoting/jaxws/JaxWsSoapFaultException.java
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jar/org/springframework/remoting/httpinvoker/HttpInvokerClientConfiguration.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-
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* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/AbstractClientHttpResponse.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/http/MediaTypeEditor.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/MissingServletRequestParamException.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/SimpleSessionStatus.java
* /opt/cola/permits/1301486287_1649248809.64/0/spring-web-5-2-20-release-sources-jar/org/springframework/web/client/ResourceAccessException.java

1.312 host-ninja 1.10.0

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1.313 busybox 1.25.0

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jseward@bzip.org

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1.314 python-dotenv 0.20.0

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django-dotenv-rw

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1.315 loguru 0.6.0

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1.318 spring-security-config 5.4.10

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/SessionCreationPolicy.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/DebugBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/core/GrantedAuthorityDefaults.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/FilterChainMapBeanDefinitionDecorator.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/authentication/package-info.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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jar/org/springframework/security/config/http/FilterInvocationSecurityMetadataSourceParser.java
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jar/org/springframework/security/config/method/ProtectPointcutPostProcessor.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/UserDetailsServiceFactoryBean.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/FilterChainBeanDefinitionParser.java
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jar/org/springframework/security/config/BeanIds.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/ContextSourceSettingPostProcessor.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/package-info.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/LdapUserServiceBeanDefinitionParser.java
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/PortMappingsBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/UserServiceBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/HttpFirewallBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/messaging/MessageSecurityMetadataSourceRegistry.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/package-info.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/DefaultFilterChainValidator.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/AuthenticationProviderBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/AbstractUserDetailsServiceBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/MatcherType.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/package-info.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/builders/FilterOrderRegistration.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/authentication/AuthenticationManagerBeanDefinitionParser.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/DefaultLoginPageConfigurer.java
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- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/ServletApiConfigurer.java
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- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/ExpressionUrlAuthorizationConfigurer.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/configuration/AutowiredBeanFactoryObjectPostProcessor.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2ClientConfigurerUtils.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/core/userdetails/UserDetailsResourceFactoryBean.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/SecurityContextConfigurer.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/CorsConfigurer.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/UrlAuthorizationConfigurer.java
- * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/annotation/method/configuration/MethodSecurityMetadataSourceAdvisorRegistrar.java

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/InitializeAuthenticationProviderBeanManagerConfigurer.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/AbstractRequestMatcherRegistry.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/Jsrf250MetadataSourceConfiguration.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/LogoutConfigurer.java
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jar/org/springframework/security/config/annotation/method/configuration/ReactiveMethodSecurityConfiguration.java
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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jar/org/springframework/security/config/Customizer.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/WebMvcSecurityConfiguration.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/reactive/ReactiveOAuth2ClientImportSelector.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/reactive/WebFluxSecurityConfiguration.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/crypto/RsaKeyConversionServicePostProcessor.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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Found in path(s):

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractConfigAttributeRequestMatcherRegist
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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Registrar.java
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/SecurityBuilder.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractInterceptUrlConfigurer.java
* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/InMemoryUserDetailsManagerConfigurer.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/RequestCacheConfigurer.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/ObjectPostProcessor.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/AnonymousConfigurer.java

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/authentication/ProviderManagerBuilder.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/method/configuration/EnableGlobalMethodSecurity.java

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/RememberMeConfigurer.java
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/rsocket/RSocketSecurity.java
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerSecurityMarker.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-

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 jar/org/springframework/security/config/annotation/authentication/configurers/ldap/LdapAuthenticationProviderCon-
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 * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
 jar/org/springframework/security/config/web/servlet/oauth2/resourceserver/OAuth2ResourceServerSecurityMarker.
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 * /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-
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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/oauth2/resourceserver/OpaqueTokenDsl.kt

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/headers/XssProtectionConfigDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/CorsDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/AuthorizeRequestsDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/WebSecurityConfigurer.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/OAuth2LoginDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerHeadersDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/headers/CacheControlDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/LogoutDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/OAuth2ClientDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/X509Dsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/oauth2/login/RedirectionEndpointDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/HttpSecurityBuilder.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/HttpConfigurationBuilder.java

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/CsrfBeanDefinitionParser.java

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* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/ldap/LdapServerBeanDefinitionParser.java

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/HttpBasicDsl.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/oauth2/client/OAuth2ClientSecurityMarker.kt

* /opt/cola/permits/1351887204_1656319601.8786132/0/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/session/SessionConcurrencyDsl.kt

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- *
- * AUTHOR
- * Mark Martinec <mark.martinec@ijs.si>, April 1999.

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1.325 swagger-integration 2.1.9

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Manifest-Version: 1.0

Bundle-Description: swagger-integration

Automatic-Module-Name: io.swagger.v3.oas.integration

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package: io.swagger

Bundle-SymbolicName: io.swagger.core.v3.swagger-integration

implementation-version: 2.1.9

Built-By: runner

Bundle-ManifestVersion: 2

Bundle-DocURL: <https://github.com/swagger-api/swagger-core/modules/swagger-integration>

Import-Package: com.fasterxml.jackson.annotation;version="[2.12,3)",com.fasterxml.jackson.databind;version="[2.12,3)",com.fasterxml.jackson.databind.annotation;version="[2.12,3)",io.github.classgraph;version="[4.8,5)",io.swagger.v3.core.converter;version="[2.1,3)",io.swagger.v3.core.jackson;version="[2.1,3)",io.swagger.v3.core.util;version="[2.1,3)",io.swagger.v3.oas.annotations;version="[2.1,3)",io.swagger.v3.oas.integration,io.swagger.v3.oas.integration.api,io.swagger.v3.oas.models;version="[2.1,3)",io.swagger.v3.oas.models.media;version="[2.1,3)",org.apache.commons.lang3;version="[3.7,4)",org.apache.commons.lang3.tuple;version="[3.7,4)",org.slf4j;version="[1.7,2)"

Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.8))"

Bundle-Developers: fehguy;email="fehguy@gmail.com";name="Tony Tam",webbron;email="webbron@gmail.com";name="Ron Ratovsky"

url: <https://github.com/swagger-api/swagger-core/modules/swagger-integration>

mode: development
Export-Package: io.swagger.v3.oas.integration;uses:="com.fasterxml.jac
kson.databind,io.swagger.v3.core.converter,io.swagger.v3.core.util,io
.swagger.v3.oas.integration.api,io.swagger.v3.oas.models,org.apache.c
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ration.api;uses:="com.fasterxml.jackson.databind,io.swagger.v3.core.c
onverter,io.swagger.v3.oas.integration,io.swagger.v3.oas.models";vers
ion="2.1.9"

Bundle-Name: swagger-integration

Bundle-Version: 2.1.9

Bundle-SCM: url="https://github.com/swagger-api/swagger-core/modules/s
wagger-integration",connection="scm:git:git@github.com:swagger-api/sw
agger-core.git/modules/swagger-integration",developer-connection="scm
:git:git@github.com:swagger-api/swagger-core.git/modules/swagger-inte
gration",tag=HEAD

Created-By: Apache Maven 3.6.3

Build-Jdk: 1.8.0_282

Found in path(s):

* /opt/cola/permits/1165124366_1631831566.71/0/swagger-integration-2-1-9-jar/META-INF/MANIFEST.MF

1.326 containerd 1.3.0

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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

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1.327 tftp-hpa 5.2

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/HttpSessionCreatedEvent.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/HttpSessionDestroyedEvent.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestWrapper.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/InsecureChannelProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/switchuser/SwitchUserGrantedAuthority.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/FilterInvocation.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/ChannelProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/LogoutFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationFilter.java

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

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

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

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- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authorization/AuthorizationWebFilter.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/util/matcher/AndServerWebExchangeMatcher.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/ContentTypeOptionsServerHttpHeadersWriter.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/WebSessionServerCsrfTokenRepository.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/util/matcher/ServerWebExchangeMatcherEntry.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/DelegatingServerAuthenticationEntryPoint.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/util/matcher/MediaTypeServerWebExchangeMatcher.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/XContentTypeOptionsServerHttpHeadersWriter.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/AbstractRememberMeServices.java
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- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/ui/LoginPageGeneratingWebFilter.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/StrictTransportSecurityServerHttpHeadersWriter.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/savedrequest/ServerRequestCacheWebFilter.java
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- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/util/matcher/ServerWebExchangeMatcher.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-

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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
 jar/org/springframework/security/web/server/header/CompositeServerHttpHeadersWriter.java
 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
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 jar/org/springframework/security/web/server/context/NoOpServerSecurityContextRepository.java
 * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
 jar/org/springframework/security/web/authentication/rememberme/PersistentTokenBasedRememberMeServices.java
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 jar/org/springframework/security/web/server/header/CacheControlServerHttpHeadersWriter.java
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 jar/org/springframework/security/web/server/ServerAuthenticationEntryPoint.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/DefaultSavedRequestMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/SessionInformationExpiredStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/CookieDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/WebAuthenticationDetailsMixin.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/ServletJackson2Module.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/transport/HttpsRedirectWebFilter.java

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Found in path(s):

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/jackson2/DefaultCsrfServerTokenMixin.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/jackson2/WebServerJackson2Module.java
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Found in path(s):

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/www/DigestAuthenticationFilter.java
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Found in path(s):

- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/package-info.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/WebExpressionConfigAttribute.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/SimpleUrlLogoutSuccessHandler.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/rememberme/CookieTheftException.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/package-info.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationSuccessHandler.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/package-info.java
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- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/websphere/package-info.java
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- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/HttpSessionRequestCache.java
- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/intercept/package-info.java
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- * /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/RedirectStrategy.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/websphere/DefaultWASUsernameAndGroupsExtractor.java

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

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

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

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

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

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

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

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

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/context/package-info.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/WebExpressionVoter.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/DelegatingAuthenticationFailureHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/EvaluationContextPostProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/AbstractVariableEvaluationContextPostProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/DelegatingAccessDeniedHandler.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/CsrfWebFilter.java

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

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

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

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

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

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

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

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

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

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

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

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servlet/support/csrf/CsrfRequestDataValueProcessor.java

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

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

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

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

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

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

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

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

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

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

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

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

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

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jar/org/springframework/security/web/server/header/ReferrerPolicyServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/http/SecurityHeaders.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandle
r.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/DefaultServerRedirectStrategy.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/util/matcher/PathPatternParserServerWebExchangeMatcher.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/HttpStatusServerEntryPoint.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.
java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authorization/ServerWebExchangeDelegatingServerAccessDeniedHan
dler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/ServerHttpBasicAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/ForwardLogoutSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/request/async/SecurityContextCallableProcessingInterceptor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerFormLoginAuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/DelegatingServerAuthenticationSuccessHandler.java
```

* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/context/WebSessionServerSecurityContextRepository.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ui/DefaultLogoutPageGeneratingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationFailureHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/ContentSecurityPolicyServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/reactive/result/view/CsrfRequestDataValueProcessor.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ForwardAuthenticationFailureHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/CsrfServerLogoutHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/FeaturePolicyServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/XXssProtectionServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/FirewalledResponse.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ui/DefaultLoginPageGeneratingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ExceptionMappingAuthenticationFailureHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ForwardAuthenticationSuccessHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/ServerX509AuthenticationConverter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/util/matcher/NegatedServerWebExchangeMatcher.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/AbstractPreAuthenticatedProcessingFilter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/header/StaticServerHttpHeadersWriter.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/RequestMatcherDelegatingAccessDeniedHandler.java
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* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/MatcherSecurityWebFilterChain.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/logout/DelegatingServerLogoutHandler.java
* /opt/ws_local/PERMITS_SQL/1081949352_1599626384.45/0/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authentication/ServerHttpBasicAuthenticationConverter.java

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Upstream-Name: libssh

Upstream-Contact: libssh@libssh.org

Andreas Schneider <asn@cryptomilk.org>

Source: <https://git.libssh.org/projects/libssh.git>

Files: *

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Files: include/libssh/auth.h
include/libssh/bignum.h
include/libssh/bind.h
include/libssh/buffer.h
include/libssh/channels.h
include/libssh/crc32.h
include/libssh/crypto.h
include/libssh/dh.h
include/libssh/ecdh.h
include/libssh/ed25519.h
include/libssh/gssapi.h
include/libssh/kex.h
include/libssh/keys.h
include/libssh/legacy.h
include/libssh/libcrypto.h
include/libssh/libcrypt.h
include/libssh/libssh.h
include/libssh/libsshpp.hpp
include/libssh/messages.h
include/libssh/misc.h
include/libssh/packet.h
include/libssh/pcap.h
include/libssh/pki.h
include/libssh/pki_priv.h
include/libssh/poll.h
include/libssh/priv.h
include/libssh/scp.h
include/libssh/server.h
include/libssh/session.h
include/libssh/sftp.h
include/libssh/socket.h
include/libssh/string.h
include/libssh/threads.h
include/libssh/wrapper.h
src/auth1.c
src/base64.c
src/bignum.c
src/bind.c
src/buffer.c

src/client.c
src/connect.c
src/crc32.c
src/ecdh.c
src/error.c
src/gcrypt_missing.c
src/init.c
src/kex.c
src/kex1.c
src/legacy.c
src/libcrypto.c
src/libgcrypt.c
src/log.c
src/messages.c
src/packet.c
src/packet1.c
src/packet_cb.c
src/packet_crypt.c
src/pcap.c
src/pki_container_openssh.c
src/pki_ed25519.c
src/server.c
src/session.c
src/sftpserver.c
src/socket.c
src/string.c
src/threads.c
src/threads/pthread.c
src/wrapper.c
tests/benchmarks/bench_raw.c
tests/benchmarks/bench_scp.c
tests/benchmarks/bench_sftp.c
tests/benchmarks/benchmarks.c
tests/benchmarks/benchmarks.h
tests/benchmarks/latency.c
tests/client/torture_algorithms.c
tests/client/torture_auth.c
tests/client/torture_connect.c
tests/client/torture_knownhosts.c
tests/client/torture_session.c
tests/test_pcap.c
tests/test_socket.c

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Files: examples/exec.c
examples/senddata.c
examples/CMakeLists.txt

include/libssh/ssh1.h
include/libssh/ssh2.h
tests/authentication.c
tests/benchmarks/bench1.sh
tests/benchmarks/bench2.sh
tests/chmodtest.c
tests/client/torture_proxycommand.c
tests/client/torture_sftp_dir.c
tests/client/torture_sftp_read.c
tests/cmdline.c
tests/connection.c
tests/generate.py
tests/sftp_stress/main.c
tests/test_exec.c
tests/test_ssh_bind_accept_fd.c
tests/test_tunnel.c
tests/tests.h
tests/unittests/torture_buffer.c
tests/unittests/torture_callbacks.c
tests/unittests/torture_channel.c
tests/unittests/torture_init.c
tests/unittests/torture_isipaddr.c
tests/unittests/torture_keyfiles.c
tests/unittests/torture_list.c
tests/unittests/torture_misc.c
tests/unittests/torture_options.c
tests/unittests/torture_pki.c
tests/unittests/torture_rand.c

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Files: examples/authentication.c
examples/connect_ssh.c
examples/examples_common.h
examples/knownhosts.c
examples/libssh_scp.c
examples/libsshpp.cpp
examples/libsshpp_noexcept.cpp
examples/proxy.c
examples/sample.c
examples/samplesftp.c
examples/samplesshd-cb.c
examples/samplesshd-kbdint.c
examples/scp_download.c
examples/sshnetcat.c

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Files: src/external/curve25519_ref.c

src/external/ed25519.c

src/external/fe25519.c

src/external/ge25519.c

src/external/ge25519_base.data

src/external/sc25519.c

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Files: tests/pkd/pkd_client.h

tests/pkd/pkd_daemon.c

tests/pkd/pkd_daemon.h

tests/pkd/pkd_hello.c

tests/pkd/pkd_keyutil.c

tests/pkd/pkd_keyutil.h

tests/pkd/pkd_util.c

tests/pkd/pkd_util.h

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Files: src/channels.c

src/channels1.c

src/gzip.c

src/known_hosts.c

src/misc.c

src/options.c

src/pki.c

src/pki_crypto.c

src/pki_gcrypt.c

src/sftp.c

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Files: include/libssh/agent.h

include/libssh/options.h

src/agent.c

src/callbacks.c

src/config.c

tests/client/torture_forward.c

tests/client/torture_request_env.c

tests/torture.c

tests/torture.c

tests/torture.h

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Files: include/libssh/curve25519.h

src/curve25519.c

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Files: include/libssh/callbacks.h

src/scp.c

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Files: src/match.c

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Files: src/auth.c

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cmake/Modules/DefineCompilerFlags.cmake
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cmake/Modules/FindArgp.cmake
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cmake/Modules/FindGCrypt.cmake
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1.330 glibc 2.31-0ubuntu9

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* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTracker.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConnectionProvider.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusMetricsTracker.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConfigurationUtil.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariPoolMXBean.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyCallableStatement.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleMetricsTrackerFactory.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfigMXBean.java

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jar/com/zaxxer/hikari/metrics/prometheus/HikariCPCollector.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/ConcurrentBag.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyResultSet.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/DriverDataSource.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/SuspendResumeLock.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/util/JavassistProxyFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfig.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyConnection.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyLeakTaskFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyFactory.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/FastList.java
* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/pool/ProxyLeakTask.java
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jar/com/zaxxer/hikari/util/ClockSource.java

* /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-
jar/com/zaxxer/hikari/metrics/PoolStats.java

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- * /opt/cola/permits/1257259274_1642793180.98/0/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/PoolEntry.java

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1.332 libpcap 1.2.1

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1.336 jline 3.11.0

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1.337 protobuf 2.4.1

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1.338 kubernetes-api 1.8.11

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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

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1.340 boost 1.71.0-6ubuntu6

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Aleksey Gurtovoy (agurtovoy@meta-comm.com)

Andrei Alexandrescu (andrewalex - at - hotmail.com) (See Boost list message of August 12, 2004 11:06:58 AM EST)

Andrew Lumsdaine ()

Anthony Williams (anthony -at- justsoftwaresolutions.co.uk)

Beman Dawes (bdawes@acm.org)

Brad King (brad.king -at- kitware.com) (See Boost list message of Wed, 21 Jul 2004 11:15:46 -0400)

Brian Osman (osman -at- vvisions.com) (See CVS log)

Bruce Barr (schmoost -at- yahoo.com) (See Boost list of Mon, 16 Aug 2004 15:06:43 -0500)

Bruno da Silva de Oliveira (bruno - at - esss.com.br)

Christain Engstrom (christian.engstrom -at- glindra.org) (See Boost list message of Mon, 30 Aug 2004 14:31:49 +0200)

Cromwell D Enage (sponage -at- yahoo.com) (See Boost list message of August 12, 2004 11:49:13 AM EST)

Dan Gohman (djk -at- cray.com) (See Boost list message of Sat, 21 Aug 2004 10:54:59 +0100)

Dan Nuffer (dan -at- nuffer.name)

Daniel Frey (d.frey -at- gmx.de, daniel.frey -at- aixigo.de)

Daniel Nuffer (dan -at- nuffer.name)

Darin Adler (darin -at- bentspoon.com) (Email to Andreas Huber, see change log)

Daryle Walker (darylew - at - hotmail.com)

Dave Abrahams (dave@boost-consulting.com)

Dave Moore (dmoore -at- viefinacial.com) (See Boost list message of 18 Dec 2003 15:35:50 -0500)

David Abrahams (dave@boost-consulting.com)

Dietmar Kuehl (dietmar_kuehl -at- yahoo.com) (Email to Andreas Huber, see change log)

Douglas Gregor (gregod -at- cs.rpi.edu, dgregor -at- cs.indiana.edu, doug.gregor -at- gmail.com)

Dr John Maddock (john - at - johnmaddock.co.uk)

Edward D. Brey (brey -at- ductape.net) (Email to Andreas Huber, see change log)

Eric Ford (un5o6n902 -at- sneakemail.com) (See Boost list message of Sun, 15 Aug 2004 10:29:13 +0100)

Eric Friedman (ebf@users.sourceforge.net)

Eric Niebler (eric@boost-consulting.com)

Fernando Cacciola (fernando_cacciola@ciudad.com.ar)

Fernando Luis Cacciola Carballal (fernando_cacciola@ciudad.com.ar)

Francois Faure (Francois.Faure -at- imag.fr) (See CVS log)
Gary Powell (powellg - at - amazon.com) (See Boost list message of 10 Feb 2004 14:22:46 -0800)
Gennadiy Rozental (rogeeff -at- mail.com) (Email to Andreas Huber, see change log)
Gottfried Ganssaue (Gottfried.Ganssaue -at- HAUFE.DE) (See Boost List message of Mon, 16 Aug 2004 10:09:19 +0200)
Gottfried Ganaue (Gottfried.Ganssaue -at- HAUFE.DE) (Alternative spelling of Gottfried Ganssaue)
Greg Colvin (gregory.colvin -at- oracle.com) (See Boost list message of Sat, 14 Aug 2004 10:57:00 +0100)
Gregory Colvin (gregory.colvin -at- oracle.com) (See Boost list message of Sat, 14 Aug 2004 10:57:00 +0100)
Gunter Winkler (gunter.winkler -at- unibw-muenchen.de) (See Boost List message of Mon, 16 Aug 2004 10:24:17 +0200)
Hartmut Kaiser (hartmut.kaiser -at- gmail.com)
Herve Bronnimann (hbr -at- poly.edu)
Herv Brnnimann (hbr -at- poly.edu)
Housemarque Oy (Ilari Kuittinen ilari.kuittinen -at- housemarque.fi)
Howard Hinnant (hinnant -at- twcnv.r.com) (See Boost list message of July 25, 2004 3:44:49 PM EST)
Hubert Holin (hubert_holin -at- users.sourceforge.net)
Indiana University ()
Itay Maman (imaman -at- users.sourceforge.net)
Jaakko Jrv (jajarvi -at- osl.iu.edu)
Jaap Suter (j.suter -at- student.utwente.nl) (See Boost list message of Thu, 16 Sep 2004 09:32:43 -0700)
Jeff Garland (jeff - at - crystalclearsoftware.com) (see Boost list post of July 25, 2004 19:31:09 -0700)
Jens Maurer (Jens.Maurer@gmx.net)
Jeremy G Siek (jsiek@osl.iu.edu)
Jeremy Siek (jsiek@osl.iu.edu)
Joel de Guzman (joel -at- boost-consulting.com) (See Boost list message of July 25, 2004 8:32:00 PM EST)
John Bandela (jbandela-at-ufl.edu)
John Maddock (john - at - johnmaddock.co.uk)
John R Bandela (jbandela-at-ufl.edu)
Jonathan Turkanis (turkanis -at- coderage dot com)
Juergen Hunold (hunold -at- ive.uni-hannover.de) (See Boost List Message of Fri, 13 Aug 2004 19:39:55 +0200)
Kevlin Henney (kevin -at- curbralan.com) (See Boost list message of Wed, 15 Sep 2004 18:15:17 +0200)
Kresimir Fresl (fresl -at- master.grad.hr) (See Boost List message of August 16, 2004 8:23:35 AM EST)
Lars Gullik Bjnnes (larsbj -at- lyx.org) (See Boost list message of Tue, 17 Aug 2004 15:49:02 +0100)
Lie-Quan Lee (liequan - at - slac.stanford.edu, llee - at - cs.indiana.edu)
Maarten Keijzer (mkeijzer -at- cs.vu.nl) (See Boost list message of Wed, 18 Aug 2004 21:43:18 +0100)
Mac Murrett (mmurrett -at- mac.com)
Marc Wintermantel (wintermantel -at- imes.mavt.ethz.ch, wintermantel -at- even-ag.ch) (See CVS log)
Michael Glassford (glassfordm - at - hotmail.com)
Michael Stevens (Michael.Stevens - at - epost.de)
Multi Media Ltd. (pdimov@mmltd.net)
Nicolai M Josuttis (solutions -at- josuttis.com) (See Boost list message of Mon, 30 Aug 2004 10:52:00 +0100)
Nikolay Mladenov (nickm -at- sitius.com) (See Boost list message of Tue, 17 Aug 2004 15:45:33 +0100)
Paul Mensonides (pmenso57 -at- comcast.net) (See Boost list message of July 21, 2004 1:12:21 AM EST)
Pavol Droba (droba -at- topmail.sk)
Peter Dimov (pdimov@mmltd.net)
R W Grosse-Kunstleve (RWGrosse-Kunstleve@lbl.gov)
Ralf W. Grosse-Kunstleve (RWGrosse-Kunstleve@lbl.gov)
Rational Discovery LLC (Greg Landrum Landrum -at- RationalDiscovery.com) (See Boost list post of Tue, 17 Aug

2004 10:35:36 +0100)

Rene Rivera (grafik/redshift-software.com, rrivera/acm.org)

Robert Ramey (ramey@www.rrsd.com)

Roland Richter (roland -at- fill.jku.at) (See Boost list post of Mon, 16 Aug 2004 22:16:55 +0200)

Roland Schwarz (roland.schwarz -at- chello.at)

Ronald Garcia (garcia -at- cs.indiana.edu) (Email to Andreas Huber, see change log)

Samuel Krempp (krempp -at- crans.ens-cachan.fr) (See Boost list message of Mon, 27 Sep 2004 13:18:36 +0200)

Stefan Seefeld (seefeld -at- sympatico.ca)

Stephen Cleary (scleary -at- jerviswebb.com) (See Boost list message of Tue, 28 Sep 2004 13:11:46 +0100)

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--- end ---

1.341 giflib 5.2.1

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1.342 openjdk-jre 11.0.11u9

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xwd v1.0.7

xwd utility

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CUP Parser Generator for Java v 0.11b

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| | GL/glxt.h | Khronos |
| | GL/wglxt.h | Khronos |
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include/GL/gl.h :

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1.344 docker 1.9.1

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1.346 netty-handler 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/KeyManagerFactoryWrapper.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslPrivateKeyMethod.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PseudoRandomFunction.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslMasterKeyHandler.java

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- * /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemX509Certificate.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/JdkAlpnSslUtils.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/JdkAlpnSslEngine.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/SslClientHelloHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-
jar/io/netty/handler/ssl/ConscryptAlpnSslEngine.java

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jar/io/netty/handler/ssl/util/SelfSignedCertificate.java

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionTicketKey.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNames.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslJavaxX509Certificate.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslContextBuilder.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ClientAuth.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNegotiationHandler.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/package-info.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/IdleStateHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/LoggingHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/NotSslRecordException.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedFile.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedNioStream.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-

jar/io/netty/handler/logging/LogLevel.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedWriteHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedInput.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/ReadTimeoutException.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/TimeoutException.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/package-info.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/ReadTimeoutHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedNioFile.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/ByteBufFormat.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslHandshakeTimeoutException.java

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemReader.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkBaseApplicationProtocolNegotiator.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SniHandler.java
* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509Certificate.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionStats.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkApplicationProtocolNegotiator.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerContext.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SupportedCipherSuiteFilter.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/package-info.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyNpnSslEngine.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslEngineMap.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslContext.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/SimpleTrustManagerFactory.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/GlobalChannelTrafficCounter.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/BouncyCastleSelfSignedCertGenerator.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslClientContext.java

* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteConverter.java

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslEngine.java

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnApplicationProtocolNegotiator.java

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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/OpenJdkSelfSignedCertGenerator.java
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* /opt/ws_local/PERMITS_SQL/1072948687_1595240769.66/0/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpSubnetFilterRule.java
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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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The zlib License could have been used instead of the Modified (3-clause) BSD License, and since the IJG License effectively subsumes the distribution conditions of the zlib License, this would have effectively placed libjpeg-turbo binary distributions under the IJG License. However, the IJG License specifically refers to the Independent JPEG Group and does not extend attribution and endorsement protections to other entities. Thus, it was desirable to choose a license that granted us the same protections for new code that were granted to the IJG for code derived from their software.

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<!-- root node -->
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        <_>

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<feature>
  <rects>
    <_>

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                  6 7 1 3 2.</_></rects>
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      </_>
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    <_>
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            54 0 5 3 2.</_>
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```

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                      6 3 6 5 3.</_></rects>
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              <_>
                <!-- tree 2 -->
                  <_>
                    <!-- root node -->
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                          <_>
                            6 1 3 14 2.</_></rects>
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John R. Hauser
2017 February 10

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

*

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

*

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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/ClassInstanceProvider.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterProviderConfiguration.java
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* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/FloatSerializer.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/AbstractStoreEventDispatcher.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/copy/package-info.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/CacheConfigurationChangeEvent.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyConfiguration.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/SourceStatistic.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/ConfigurationChangeSupport.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/AbstractResourcePool.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/event/EventOrdering.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/CacheStatistics.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/config/CacheRuntimeConfiguration.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/xml/CoreCacheConfigurationParser.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Js107CacheConfigurationParser.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/package-info.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/Js107LatencyMonitor.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/DefaultSizeOfEngineProviderConfigurationParser.java
* /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProvider.java
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- */

Found in path(s):

- * /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/ArrayUtils.java
- * /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MemberUtils.java
- * /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/ClassUtils.java
- * /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MethodUtils.java
- * /opt/cola/permits/1135872409_1613620769.24/0/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/ConstructorUtils.java

1.358 libcap-ng 0.7.9 2.1build1

1.358.1 Available under license :

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1.360 ehcache-impl 3.8.1

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jar/org/ehcache/impl/internal/classes/commonslang/ClassUtils.java
* /opt/cola/permits/1258059351_1643027373.36/ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/reflect/MethodUtils.java
* /opt/cola/permits/1258059351_1643027373.36/ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/ArrayUtils.java
* /opt/cola/permits/1258059351_1643027373.36/ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/reflect/ConstructorUtils.java
* /opt/cola/permits/1258059351_1643027373.36/ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/classes/commonslang/reflect/MemberUtils.java

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- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/RobustLoaderWriterResilienceStrategy.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/StringSerializer.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/DefaultTimeSourceService.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/AbstractResilienceStrategy.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterConfiguration.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/spi/serialization/DefaultSerializationProviderFactory.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/events/CacheEventDispatcherImpl.java
- * /opt/cola/permits/1258059351_1643027373.36/0/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyProviderConfiguration.java
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1.361 util-linux 2.22.2

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1.362 postgresql-jdbc 42.2.14

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1.363 kmod 23

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That's all there is to it!

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

Anton Mitrofanov <BugMaster@narod.ru>

Jason Garrett-Glaser <darkshikari@gmail.com>

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

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Keir Mierle <mierle@gmail.com>
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1.372 Ivm2 2.02.162

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Here is a list of the main contributors to lm-sensors version 3.

- * Frodo Looijaard
Original author of libsensors, sensors-detect, sensors and isadump.
- * Merlin Hughes
Original author of sensord.
- * Bob Schlaermann
Dynamic chip feature detection (a.k.a. generic chip support) in
libsensors and sensors.
- * Mark M. Hoffman
Many improvements to the libsensors configuration file scanner.
- * Jean Delvare
New libsensors API, and migration of sensors and sensord thereto.
Many optimizations in libsensors and sensors.
Configuration file converter.
Rewrite of sensors-detect.
Support for multiple configuration files in libsensors.

1.378 lua 5.1.4

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1.379 nss-pam-ldapd 0.9.11

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1.380 libarchive 3.3.3

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1.381 netty-resolver 4.1.51.Final

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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-resolver/pom.xml

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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolverGroup.java

* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/SimpleNameResolver.java

* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolver.java

* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NameResolver.java

* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolverGroup.java

* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/package-info.java

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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/ResolvedAddressTypes.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntries.java

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* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultAddressResolverGroup.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultNameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AbstractAddressResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntriesResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetNameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultHostsFileEntriesResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileParser.java

```
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-
jar/io/netty/resolver/InetSocketAddressResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-
jar/io/netty/resolver/CompositeNameResolver.java
* /opt/ws_local/PERMITS_SQL/1072948623_1595240780.88/0/netty-resolver-4-1-51-final-sources-
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1.382 reactive-streams 1.0.3

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* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-
jar/org/reactivestreams/Publisher.java
```

* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/FlowAdapters.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Processor.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Subscription.java
* /opt/cola/permits/1135840663_1613613063.73/0/reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Subscriber.java

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1.384 kubernetes-client 1.8.11

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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1.388 inotify-tools 3.14

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1.392 pcre 10.34-7

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1.393 freerdp 2.0.0-rc4

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- >>> JOpt Simple (net.sf.jopt-simple:jopt-simple)
- >>> ASM 4.0 (org.ow2.asm:asm)

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

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

RC4 is a registered trademark of RSA Laboratories.

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This code implements the MD5 message-digest algorithm. The algorithm is due to Ron Rivest. This code was written by Colin Plumb in 1993, no copyright is claimed. This code is in the public domain; do with it what you wish.

Equivalent code is available from RSA Data Security, Inc. This code has been tested against that, and is equivalent, except that you don't need to include two pages of legalese with every copy.

To compute the message digest of a chunk of bytes, declare an MD5Context structure, pass it to MD5Init, call MD5Update as needed on buffers full of bytes, and then call MD5Final, which will fill a supplied 16-byte array with the digest.

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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/push/PushRegistryConfig.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/StrongReferenceGaugeFunction.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/ipc/http/HttpSender.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/binder/kafka/KafkaConsumerMetrics.java
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jar/io/micrometer/core/ipc/http/HttpStatusClass.java
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jar/io/micrometer/core/instrument/util/NamedThreadFactory.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/httpcomponents/PoolingHttpClientConnectionManagerMetricsBinder.java
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jar/io/micrometer/core/instrument/binder/mongodb/MongoMetricsConnectionPoolListener.java
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jar/io/micrometer/core/instrument/binder/jetty/JettyServerThreadPoolMetrics.java
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jar/io/micrometer/core/instrument/binder/http/HttpServletRequestTagsProvider.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/config/validate/PropertyValidator.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/step/StepTuple2.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/distribution/FixedBoundaryVictoriaMetricsHistogram.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
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- * /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/MockClock.java
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- * /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Measurement.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/InvalidConfigurationException.java
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/DoubleFormat.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/TimedExecutor.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeDistributionSummary.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/StringUtils.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopFunctionTimer.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepCounter.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmMemoryMetrics.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardTimer.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/annotation/Incubating.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/TimeWindowPercentileHistogram.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeTimer.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/tomcat/TomcatMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopFunctionCounter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardConfig.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/HistogramSnapshot.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/TimedExecutorService.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/HistogramSupport.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/annotation/Counted.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/pause/ClockDriftPauseDetector.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopMeter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeFunctionCounter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/package-info.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeCounter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardRate.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/Search.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/FunctionTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeMeter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardGauge.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmGcMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/package-info.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/lang/NonNullFields.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Tag.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeFunctionTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/pause/package-info.java

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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/AbstractPartition.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardClock.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/package-info.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/AbstractDistributionSummary.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/DefaultLongTaskTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/package-info.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisher.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/HazelcastCacheMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/NamingConvention.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/lang/NonNull.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/logging/LogbackMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Counter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/ClassLoaderMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardCounter.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/GuavaCacheMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepFunctionTimer.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/ExecutorServiceMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/DefaultGauge.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jpa/HibernateMetrics.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepDistributionSummary.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopGauge.java

* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/TimeWindowFixedBoundaryHistogram.java

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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/util/package-info.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-
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* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/InternalLogLevel.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/Slf4JLogger.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/AbstractInternalLogger.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/InternalLoggerFactory.java
* /opt/ws_local/PERMITS_SQL/1089949011_1600184760.1/0/micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/JdkLoggerFactory.java

1.403 ipmi-tool 1.8.18

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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanCreationNotAllowedException.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/FactoryBeanNotInitializedException.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/BeanDefinitionDecorator.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/MethodReplacer.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanExpressionException.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/wiring/BeanWiringInfoResolver.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/AbstractComponentDefinition.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/SecurityContextProvider.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/SortDefinition.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/XmlBeanDefinitionStoreException.java
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jar/org/springframework/beans/factory/groovy/GroovyBeanDefinitionReader.java
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jar/org/springframework/beans/propertyeditors/PathEditor.java
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jar/org/springframework/beans/factory/config/ConstructorArgumentValues.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
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jar/org/springframework/beans/factory/xml/ParserContext.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/GenericTypeAwarePropertyDescriptor.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/DisposableBeanAdapter.java
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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanDefinitionHolder.java
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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/StringArrayPropertyEditor.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/TypeConverterDelegate.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/ConfigurableBeanFactory.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/ResourceEntityResolver.java
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jar/org/springframework/beans/PropertyValuesEditor.java
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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyEditorRegistrySupport.java

* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanFactoryExtensions.kt

* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/MutablePropertyValues.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/BeanFactoryAnnotationUtils.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/InvalidPropertyException.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/DefaultDocumentLoader.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/PropertyComparator.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/DisposableBean.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanInstantiationException.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/CannotLoadBeanClassException.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/AutowiredCandidateQualifier.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CustomBooleanEditor.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/RequiredAnnotationBeanPostProcessor.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/UnsatisfiedDependencyException.java

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* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/SimpleTypeConverter.java

* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/propertyeditors/TimeZoneEditor.java
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/groovy/GroovyDynamicElementReader.groovy
* /opt/cola/permits/1301486271_1649248813.39/0/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/ExtendedBeanInfoFactory.java

1.405 spring-security-core 5.3.4.RELEASE

1.405.1 Available under license :

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

* Determines if the { @link #getAuthentication() } has permission to access the target
* given the permission

* @param target the target domain object to check permission on

* @param permission the permission to check on the domain object (i.e. "read",

* "write", etc).

* @return true if permission is granted to the { @link #getAuthentication() }, else

* false

*/

Found in path(s):

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

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- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/DelegatingReactiveAuthenticationManager.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/Transient.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsPasswordService.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/MessageDigestPasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/scheduling/DelegatingSecurityContextTaskScheduler.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorityReactiveAuthorizationManager.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableListDeserializer.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/JdbcUserDetailsManager.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/DefaultMethodSecurityExpressionHandler.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/KeyBasedPersistenceTokenService.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/LdapShaPasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableListMixin.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/concurrent/DelegatingSecurityContextCallable.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/concurrent/DelegatingSecurityContextRunnable.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PrePostAdviceReactiveMethodInterceptor.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/CachingUserDetailsService.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Md4PasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/DelegatingPasswordEncoder.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/BadCredentialsExceptionMixin.java
- * /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-

jar/org/springframework/security/crypto/password/Pbkdf2PasswordEncoder.java

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

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

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/**

*

* @param authentication represents the user in question. Should not be null.

* @param targetDomainObject the domain object for which permissions should be

* checked. May be null in which case implementations should return false, as the null

- * condition can be checked explicitly in the expression.
- * @param permission a representation of the permission object as supplied by the
- * expression system. Not null.
- * @return true if the permission is granted, false otherwise

*/

Found in path(s):

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

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

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

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authorization/AuthorizationDecision.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/Md4.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java
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jar/org/springframework/security/core/SpringSecurityCoreVersion.java
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jar/org/springframework/security/core/parameters/P.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java
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*/
/**
* Base64 encoder which is a reduced version of Robert Harder's public domain
* implementation (version 2.3.7). See <a
* href="http://iharder.sourceforge.net/current/java/base64/">http://iharder.sourceforge.net/current/java/base64/</a>
for more information.
* <p>
* For internal use only.
*
* @author Luke Taylor
* @since 3.0
* @deprecated Use java.util.Base64
*/
```

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

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

/**

* A token issued by { @link TokenService }.

*

* <p>

* It is important that the keys assigned to tokens are sufficiently randomised and
* secured that they can serve as identifying a unique user session. Implementations of
* { @link TokenService } are free to use encryption or encoding strategies of their choice.
* It is strongly recommended that keys are of sufficient length to balance safety against
* persistence cost. In relation to persistence cost, it is strongly recommended that
* returned keys are small enough for encoding in a cookie.

* </p>

*

* @author Ben Alex

* @since 2.0.1

*/

Found in path(s):

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

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

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

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jar/org/springframework/security/core/ComparableVersion.java
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jar/org/springframework/security/jackson2/CoreJackson2Module.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/UserMixin.java
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jar/org/springframework/security/jackson2/UnmodifiableSetDeserializer.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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jar/org/springframework/security/jackson2/UnmodifiableSetMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/RememberMeAuthenticationTokenMixin.java
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jar/org/springframework/security/jackson2/SimpleGrantedAuthorityMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenMixin.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
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jar/org/springframework/security/converter/RsaKeyConverters.java
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jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java
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jar/org/springframework/security/crypto/argon2/Argon2PasswordEncoder.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java
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jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java
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jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java
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jar/org/springframework/security/core/token/SecureRandomFactoryBean.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/ExpressionBasedPreInvocationAdvice.java
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jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AuthenticationManagerResolver.java
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jar/org/springframework/security/crypto/encrypt/CipherUtils.java
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jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/StringKeyGenerator.java
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jar/org/springframework/security/crypto/keygen/KeyGenerators.java
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jar/org/springframework/security/crypto/encrypt/AesBytesEncryptor.java
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jar/org/springframework/security/crypto/encrypt/BytesEncryptor.java
* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesGcmBytesEncryptor.java
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jar/org/springframework/security/access/intercept/MethodInvocationPrivilegeEvaluator.java
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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/event/AuthenticationFailureLockedEvent.java

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* /opt/ws_local/PERMITS_SQL/1081949690_1599626417.25/0/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/JsR250MethodSecurityMetadataSource.java

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

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

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Found in path(s):

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

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1.406 python-multipart 0.0.5

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1.408 junixsocket-common 2.3.2

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 */
```

Found in path(s):

```
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/Closeables.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocket.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketCredentials.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXServerSocket.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/NativeLibraryLoader.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketCapability.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketImpl.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/SuppressFBWarnings.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/AFUNIXSocketAddress.java
* /opt/ws_local/PERMITS_SQL/1046144794_1589880088.21/0/junixsocket-common-2-3-2-sources-
jar/org/newsclub/net/unix/NativeUnixSocket.java
```

1.409 fribidi 1.0.11

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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket08FrameEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker07.java
```

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketCloseStatus.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/CloseWebSocketFrame.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionFilter.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocket00FrameDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshakerFactory.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker13.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerProtocolHandshakeHandler.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/CorruptedWebSocketFrameException.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker00.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerProtocolHandler.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionFilterProvider.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketDecoderConfig.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker08.java
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- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockZlibDecoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrameDecoderDelegate.java
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jar/io/netty/handler/codec/http/websocketx/Utf8FrameValidator.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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jar/io/netty/handler/codec/http/HttpMessageUtil.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpServerExpectContinueHandler.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/CorsConfig.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/CorsHandler.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/META-INF/native-image/io.netty/codec-http/native-image.properties
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io.netty.handler.codec/http/cors/CorsConfigBuilder.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-codec-http/pom.xml
```


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```
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/AbstractMemoryHttpData.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpContentDecompressor.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/package-info.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/InterfaceHttpPostRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/HttpPostRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/spdy/SpdyHttpResponseStreamIdHandler.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpResponseDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/spdy/DefaultSpdySettingsFrame.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/DefaultCookie.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/package-info.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/DiskAttribute.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpMethod.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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jar/io/netty/handler/codec/http/DefaultHttpObject.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpResponseEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpContentDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpObjectAggregator.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpObjectDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpContent.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/InterfaceHttpData.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/QueryStringEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpHeaders.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/Attribute.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketHandshakeException.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshakerFactory.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/DefaultHttpDataFactory.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/spdy/SpdyHttpHeaders.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/DefaultHttpResponse.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/AbstractDiskHttpData.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpObject.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-

jar/io/netty/handler/codec/rtsp/RtspVersions.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpClientCodec.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket00FrameEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker00.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker07.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/MemoryAttribute.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpMessage.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/LastHttpContent.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpVersion.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/RtspObjectDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/DiskFileUpload.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/ContinuationWebSocketFrame.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/MixedFileUpload.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/RtspHeaders.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/FileUpload.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/RtspResponseStatuses.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/DefaultHttpRequest.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpRequest.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/RtspRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/DefaultLastHttpContent.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketUtil.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/spdy/package-info.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/BinaryWebSocketFrame.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-

jar/io/netty/handler/codec/rtsp/RtspMethods.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/AbstractHttpData.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/CaseIgnoringComparator.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpResponseStatus.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/RtspResponseEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/spdy/SpdyHttpEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/TextWebSocketFrame.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpObjectEncoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/package-info.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/MemoryFileUpload.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/spdy/SpdySession.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpConstants.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/PongWebSocketFrame.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/HttpPostStandardRequestDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/MixedAttribute.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/InternalAttribute.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpContentCompressor.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-

jar/io/netty/handler/codec/http/QueryStringDecoder.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/HttpData.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpHeaderDateFormat.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketVersion.java
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpServerUpgradeHandler.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ServerCookieEncoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieDecoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieEncoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/Cookie.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieHeaderNames.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CombinedHttpHeaders.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ClientCookieDecoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpExpectationFailedEvent.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspEncoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ServerCookieDecoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpScheme.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/package-info.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CookieUtil.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/EmptyHttpHeaders.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpUtil.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ClientCookieEncoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-

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jar/io/netty/handler/codec/http/cookie/CookieUtil.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/rtsp/RtspDecoder.java
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jar/io/netty/handler/codec/http/websocketx/WebSocket13FrameDecoder.java
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- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyWindowUpdateFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySessionStatus.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyWindowUpdateFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyDataFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySynReplyFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyStreamFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyRstStreamFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/FullHttpResponse.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySynStreamFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyPingFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/FullHttpRequest.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyDataFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyVersion.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultFullHttpResponse.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySettingsFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyGoAwayFrame.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/package-info.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockRawEncoder.java
- * /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketClientProtocolHandler.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketFrameAggregator.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpDecoder.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpCodec.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaders.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultFullHttpRequest.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyStreamFrame.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyPingFrame.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdySynStreamFrame.java

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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyRstStreamFrame.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrame.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/ComposedLastHttpContent.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketClientProtocolHandshakeHandler.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyGoAwayFrame.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySessionHandler.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyHeaders.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/FullHttpRequest.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketFrameDecoder.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyCodecUtil.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockEncoder.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyHeadersFrame.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockZlibEncoder.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockJZlibEncoder.java

* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyStreamStatus.java

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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketProtocolHandler.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
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* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/HttpServerKeepAliveHandler.java
* /opt/ws_local/PERMITS_SQL/1072411888_1594999339.26/0/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketChunkedInput.java
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1.417 kubernetes-apimachinery 1.8.11

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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

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1.418 libevent 2.1.11-stable-1

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1.419 coturn 4.5.1.3

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jar/org/springframework/retry/policy/SimpleRetryPolicy.java
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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/interceptor/FixedKeyGenerator.java

* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/CircuitBreakerRetryPolicy.java

* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/ExpressionRetryPolicy.java

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* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-

jar/org/springframework/classify/util/MethodResolver.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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jar/org/springframework/retry/interceptor/RetryInterceptorBuilder.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/annotation/RetryConfiguration.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/ThreadWaitSleeper.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/annotation/Retryable.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/interceptor/Retryable.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/classify/util/SimpleMethodInvoker.java
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- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/ExceptionClassifierRetryPolicy.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/AlwaysRetryPolicy.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/ExhaustedRetryException.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/RetryCacheCapacityExceededException.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/PatternMatchingClassifier.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/annotation/Classifier.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/BackToBackPatternClassifier.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/RetrySimulator.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/SoftReferenceMapRetryContextCache.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/interceptor/NewMethodArgumentsIdentifier.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryPolicy.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/ClassifierSupport.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/MapRetryContextCache.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RecoveryCallback.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/BackOffInterruptedException.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/Classifier.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/SleepingBackOffPolicy.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/RetryContextCache.java
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- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/ObjectWaitSleeper.java
- * /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-

jar/org/springframework/retry/RetryCallback.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/support/RetrySimulation.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/interceptor/MethodArgumentsKeyGenerator.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/classify/PatternMatcher.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/RetryContext.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/policy/CompositeRetryPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/RetryListener.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/policy/TimeoutRetryPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/interceptor/MethodInvocationRecoverer.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/classify/ClassifierAdapter.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/RetryState.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/TerminatedRetryException.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/listener/RetryListenerSupport.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/Sleeper.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/BackOffContext.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/BackOffPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/policy/NeverRetryPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/RetryException.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/StatelessBackOffPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/RetryOperations.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/support/RetrySynchronizationManager.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/support/DefaultRetryState.java
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jar/org/springframework/retry/backoff/UniformRandomBackOffPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/context/RetryContextSupport.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/support/RetryTemplate.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/FixedBackOffPolicy.java
* /opt/cola/permits/1135864284_1613618157.58/0/spring-retry-1-2-5-release-sources-1-
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1.421 opus 1.3.1

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1.422 curl 7.62.0-DEV

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=====

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1.425 ipmiutil 2.9.9

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Upstream-Contact: Andy Cress <arcress@users.sourceforge.net>

Source: <http://ipmiutil.sourceforge.net>

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Upstream-Name: ipmiutil

Upstream-Contact: Andy Cress <arcress@users.sourceforge.net>

Source: <http://ipmiutil.sourceforge.net>

Comment: This package was debianized by Andy Cress on 2010-10-29, with Debian package updates by Alex Waite on 2013-06-14

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Upstream-Name: ipmiutil

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Source: <http://ipmiutil.sourceforge.net>

<http://www.openmash.org/lxr/source/src/getopt.c?c=gsm>

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Metadata-Version: 2.1

Name: databases

Version: 0.5.5

Summary: Async database support for Python.

Home-page: <https://github.com/encode/databases>

Author: Tom Christie

Author-email: tom@tomchristie.com

License: BSD

Description: # Databases

```
<p>
<a href="https://github.com/encode/databases/actions">
  
</a>
<a href="https://pypi.org/project/databases/">
  
</a>
</p>
```

Databases gives you simple asyncio support for a range of databases.

It allows you to make queries using the powerful [SQLAlchemy Core][sqlalchemy-core] expression language, and provides support for PostgreSQL, MySQL, and SQLite.

Databases is suitable for integrating against any async Web framework, such as [Starlette][starlette], [Sanic][sanic], [Responder][responder], [Quart][quart], [aiohttp][aiohttp], [Tornado][tornado], or [FastAPI][fastapi].

****Documentation**:** https://www.encode.io/databases/

****Requirements**:** Python 3.6+

Installation

```
```shell
$ pip install databases
```
```

You can install the required database drivers with:

```
```shell
$ pip install databases[postgresql]
$ pip install databases[mysql]
$ pip install databases[sqlite]
```
```

Default driver support is provided using one of [asyncpg][asyncpg], [aiomysql][aiomysql], or [aiosqlite][aiosqlite].

You can also use other database drivers supported by `databases`:

```
```shel
```

```
$ pip install databases[postgresql+aiopg]
$ pip install databases[mysql+asyncmy]
...

```

Note that if you are using any synchronous SQLAlchemy functions such as `engine.create_all()` or `[alembic][alembic]` migrations then you still have to install a synchronous DB driver: `[psycopg2][psycopg2]` for PostgreSQL and `[pymysql][pymysql]` for MySQL.

---

## ## Quickstart

For this example we'll create a very simple SQLite database to run some queries against.

```
```shell
$ pip install databases[sqlite]
$ pip install ipython
...

```

We can now run a simple example from the console.

Note that we want to use `ipython` here, because it supports using `await` expressions directly from the console.

```
```python
Create a database instance, and connect to it.
from databases import Database
database = Database('sqlite:///example.db')
await database.connect()

Create a table.
query = """CREATE TABLE HighScores (id INTEGER PRIMARY KEY, name VARCHAR(100), score
INTEGER)"""
await database.execute(query=query)

Insert some data.
query = "INSERT INTO HighScores(name, score) VALUES (:name, :score)"
values = [
 {"name": "Daisy", "score": 92},
 {"name": "Neil", "score": 87},
 {"name": "Carol", "score": 43},
]
await database.execute_many(query=query, values=values)

#Run a database query.
query = "SELECT * FROM HighScores"
rows = await database.fetch_all(query=query)

```



```
print('High Scores:', rows)
'''
```

Check out the documentation on [making database queries](https://www.encode.io/databases/database\_queries/) for examples of how to start using databases together with SQLAlchemy core expressions.

&mdash; &mdash;

Databases is a

BSD licensed code. Designed & built in Brighton, England.

[sqlalchemy-core]: <https://docs.sqlalchemy.org/en/latest/core/>

[sqlalchemy-core-tutorial]: <https://docs.sqlalchemy.org/en/latest/core/tutorial.html>

[alembic]: <https://alembic.sqlalchemy.org/en/latest/>

[psycopg2]: <https://www.psycopg.org/>

[pymysql]: <https://github.com/PyMySQL/PyMySQL>

[asyncpg]: <https://github.com/MagicStack/asyncpg>

[aiomysql]: <https://github.com/aio-libs/aiomysql>

[aiosqlite]: <https://github.com/jreese/aiosqlite>

[starlette]: <https://github.com/encode/starlette>

[sanic]: <https://github.com/huge-success/sanic>

[responder]: <https://github.com/kennethreitz/responder>

[quart]: <https://gitlab.com/pgjones/quart>

[aiohttp]: <https://github.com/aio-libs/aiohttp>

[tornado]: <https://github.com/tornadoweb/tornado>

[fastapi]: <https://github.com/tiangolo/fastapi>

Platform: UNKNOWN

Classifier: Development Status :: 3 - Alpha

Classifier: Environment :: Web Environment

Classifier: Intended Audience :: Developers

Classifier: License :: OSI Approved :: BSD License

Classifier: Operating System :: OS Independent

Classifier: Topic :: Internet :: WWW/HTTP

Classifier: Programming Language :: Python :: 3

Classifier: Programming Language :: Python :: 3.6

Classifier: Programming Language :: Python :: 3.7

Classifier: Programming Language :: Python :: 3.8

Classifier: Programming Language :: Python :: 3.9

Classifier: Programming Language :: Python :: 3.10

Classifier: Programming Language :: Python :: 3 :: Only

Requires-Python: >=3.6

Description-Content-Type: text/markdown

Provides-Extra: postgresql

Provides-Extra: mysql

Provides-Extra: mysql+asyncmy

Provides-Extra: sqlite  
Provides-Extra: postgresql+aiopg

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# 1.428 spring-context 5.2.20.RELEASE

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jar/org/springframework/scheduling/concurrent/ExecutorConfigurationSupport.java  
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jar/org/springframework/context/support/AbstractRefreshableApplicationContext.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-

jar/org/springframework/cache/interceptor/SimpleKey.java

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/\*\*

\* {@link FactoryBean} that obtains a WebSphere {@link javax.management.MBeanServer}

\* reference through WebSphere's proprietary {@code AdminServiceFactory} API,

\* available on WebSphere 5.1 and higher.

\*

\* <p>Exposes the {@code MBeanServer} for bean references.

\*

\* <p>This {@code FactoryBean} is a direct alternative to {@link MBeanServerFactoryBean},

\* which uses standard JMX 1.2 API to access the platform's {@link MBeanServer}.

```
*
* <p>See the javadocs for WebSphere's
* <a
href="https://www.ibm.com/support/knowledgecenter/SSEQTJ_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs
/com/ibm/websphere/management/AdminServiceFactory.html">{ @code AdminServiceFactory }
* and
* <a
href="https://www.ibm.com/support/knowledgecenter/SSEQTJ_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs
/com/ibm/websphere/management/MBeanFactory.html">{ @code MBeanFactory }.
*
* @author Juergen Hoeller
* @author Rob Harrop
* @since 2.0.3
* @see javax.management.MBeanServer
* @see MBeanServerFactoryBean
*/
```

Found in path(s):

```
* /opt/cola/permits/1301998088_1649311102.01/0/spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/support/WebSphereMBeanServerFactoryBean.java
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* /opt/cola/permits/1301998088_1649311102.01/0/spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/metadata/ManagedOperation.java
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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/MessageSourceResourceBundleLocator.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/ContextLifecycleScheduledTaskRegistrar.java  
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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/standard/YearMonthFormatter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/standard/TemporalAccessorParser.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/cache/annotation/CacheEvict.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-



jar/org/springframework/scripting/groovy/GroovyObjectCustomizer.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/context/support/GenericXmlApplicationContext.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/standard/TemporalAccessorPrinter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/remoting/support/RemoteInvocationUtils.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/standard/DurationFormatter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/cache/interceptor/KeyGenerator.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/scheduling/annotation/Schedules.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/cache/annotation/Cacheable.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/standard/PeriodFormatter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/support/FormatterPropertyEditorAdapter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/instrument/classloading/weblogic/WebLogicLoadTimeWeaver.java  
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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/ui/ModelMapExtensions.kt  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/ui/ModelExtensions.kt  
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*/
/**
* Indicates that a component is only eligible for registration when all
* { @linkplain #value specified conditions } match.
*
* <p>A condition is any state that can be determined programmatically
* before the bean definition is due to be registered (see { @link Condition } for details).
*
* <p>The { @code @Conditional } annotation may be used in any of the following ways:
*
* as a type-level annotation on any class directly or indirectly annotated with
* { @code @Component }, including { @link Configuration @Configuration } classes
* as a meta-annotation, for the purpose of composing custom stereotype
* annotations
* as a method-level annotation on any { @link Bean @Bean } method
*
*
* <p>If a { @code @Configuration } class is marked with { @code @Conditional },
* all of the { @code @Bean } methods, { @link Import @Import } annotations, and
* { @link ComponentScan @ComponentScan } annotations associated with that
* class will be subject to the conditions.
*
* <p>NOTE: Inheritance of { @code @Conditional } annotations
* is not supported; any conditions from superclasses or from overridden
* methods will not be considered. In order to enforce these semantics,
* { @code @Conditional } itself is not declared as
* { @link java.lang.annotation.Inherited @Inherited }; furthermore, any
* custom composed annotation that is meta-annotated with
* { @code @Conditional } must not be declared as { @code @Inherited }.
*
* @author Phillip Webb
* @author Sam Brannen
* @since 4.0
* @see Condition
*/

```

Found in path(s):

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Conditional.java

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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/SpringConstraintValidatorFactory.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/MonthDayFormatter.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/ScriptEvaluator.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/AnnotationDrivenBeanDefinitionParser.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/CacheConfig.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Role.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/StandardScriptEvalException.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/money/CurrencyUnitFormatter.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedOperationParameters.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/PercentStyleFormatter.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/EventListenerFactory.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteTimeoutException.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/YearMonthFormatter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/PayloadApplicationEvent.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/PeriodFormatter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedOperationParameter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedMetric.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ComponentScans.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedOperation.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedResource.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/DurationFormatter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/config/LangNamespaceHandler.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/CronTrigger.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ImportResource.java

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/\*\*

\* Abstract the invocation of a cache operation.

\*

\* <p>Does not provide a way to transmit checked exceptions but

\* provide a special exception that should be used to wrap any

\* exception that was thrown by the underlying invocation.

\* Callers are expected to handle this issue type specifically.

\*  
\* @author Stephane Nicoll  
\* @since 4.1  
\*/

Found in path(s):

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperationInvoker.java

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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/FilterType.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Description.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/concurrent/CustomizableThreadFactory.java

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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/MessageSourceResourceBundle.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateParser.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateTimeParser.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/ReadablePartialPrinter.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/i18n/TimeZoneAwareLocaleContext.java

\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-

jar/org/springframework/validation/beanvalidation/OptionalValidatorFactoryBean.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/joda/MillisecondInstantPrinter.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/context/i18n/LocaleContext.java  
\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-  
jar/org/springframework/format/datetime/joda/LocalTimeParser.java  
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jar/org/springframework/context/ApplicationEventPublisherAware.java  
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jar/org/springframework/context/annotation/ImportAware.java  
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jar/org/springframework/context/annotation/ConflictingBeanDefinitionException.java  
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jar/org/springframework/jmx/export/notification/NotificationPublisherAware.java  
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  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/SpringValidatorAdapter.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClassPostProcessor.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/support/BindingAwareModelMap.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/AbstractApplicationContext.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/support/BindingAwareConcurrentModel.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/SourceFilteringListener.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClassUtils.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/LocalValidatorFactoryBean.java
  - \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/index/CandidateComponentsIndexLoader.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/expression/AnnotatedElementKey.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/IntervalTask.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/FixedRateTask.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/CurrencyStyleFormatter.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/CronTask.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/AnnotationAsyncExecutionInterceptor.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/AsyncConfigurer.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/concurrent/ConcurrentTaskScheduler.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/instrument/classloading/SimpleInstrumentableClassLoader.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/BeanFactoryCacheOperationSourceAdvisor.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheInterceptor.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiAccessor.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/standard/DateTimeContext.java



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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/NamedCacheResolver.java

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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/expression/BeanFactoryAccessor.java

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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperationSource.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationEventPublisher.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/Scheduled.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheProxyFactoryBean.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/CacheManager.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ClassPathBeanDefinitionScanner.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/AbstractMessageSource.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/Cache.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/GenericApplicationContext.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperationSourcePointcut.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/ReloadableResourceBundleMessageSource.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/config/PropertyPlaceholderBeanDefinitionParser.java
- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiTemplateEditor.java
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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationEvent.java

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\* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteConnectFailureException.java

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- \* /opt/cola/permits/1301998088\_1649311102.01/0/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/naming/IdentityNamingStrategy.java
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# Contributor Covenant Code of Conduct

## Our Pledge

In the interest of fostering an open and welcoming environment, we as

contributors and maintainers pledge to making participation in our project and our community a harassment-free experience for everyone, regardless of age, body size, disability, ethnicity, sex characteristics, gender identity and expression, level of experience, education, socio-economic status, nationality, personal appearance, race, religion, or sexual identity and orientation.

## ## Our Standards

Examples of behavior that contributes to creating a positive environment include:

- \* Using welcoming and inclusive language
- \* Being respectful of differing viewpoints and experiences
- \* Gracefully accepting constructive criticism
- \* Focusing on what is best for the community
- \* Showing empathy towards other community members

Examples of unacceptable behavior by participants include:

- \* The use of sexualized language or imagery and unwelcome sexual attention or advances
- \* Trolling, insulting/derogatory comments, and personal or political attacks
- \* Public or private harassment
- \* Publishing others' private information, such as a physical or electronic address, without explicit permission
- \* Other conduct which could reasonably be considered inappropriate in a professional setting

## ## Our Responsibilities

Project maintainers are responsible for clarifying the standards of acceptable behavior and are expected to take appropriate and fair corrective action in response to any instances of unacceptable behavior.

Project maintainers have the right and responsibility to remove, edit, or reject comments, commits, code, wiki edits, issues, and other contributions that are not aligned to this Code of Conduct, or to ban temporarily or permanently any contributor for other behaviors that they deem inappropriate, threatening, offensive, or harmful.

## ## Scope

This Code of Conduct applies both within project spaces and in public spaces when an individual is representing the project or its community. Examples of representing a project or community include using an official project e-mail address, posting via an official social media account, or acting as an appointed representative at an online or offline event. Representation of a project may be further defined and clarified by project maintainers.

## ## Enforcement

Instances of abusive, harassing, or otherwise unacceptable behavior may be reported by contacting the project team at [report@palletsprojects.com](mailto:report@palletsprojects.com). All complaints will be reviewed and investigated and will result in a response that is deemed necessary and appropriate to the circumstances. The project team is obligated to maintain confidentiality with regard to the reporter of an incident. Further details of specific enforcement policies may be posted separately.

Project maintainers who do not follow or enforce the Code of Conduct in good faith may face temporary or permanent repercussions as determined by other members of the project's leadership.

## ## Attribution

This Code of Conduct is adapted from the [Contributor Covenant][homepage], version 1.4, available at <https://www.contributor-covenant.org/version/1/4/code-of-conduct.html>

[homepage]: <https://www.contributor-covenant.org>

For answers to common questions about this code of conduct, see <https://www.contributor-covenant.org/faq>

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\* /opt/cola/permits/1298235603\_1649268976.82/0/click-8-1-2-tar-gz/click-8.1.2/CODE\_OF\_CONDUCT.md

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.. \_contrib:

```
=====
click-contrib
=====
```

As the userbase of Click grows, more and more major feature requests pop up in Click's bugtracker. As reasonable as it may be for those features to be bundled with Click instead of being a standalone project, many of those requested features are either highly experimental or have unproven practical use, while potentially being a burden to maintain.

This is why `click-contrib_` exists. The GitHub organization is a collection of possibly experimental third-party packages whose featureset does not belong into Click, but also a playground for major features that may be added to Click in the future. It is also meant to coordinate and concentrate effort on writing third-party extensions for Click, and to ease the effort of searching for such extensions. In that sense it could be described as a low-maintenance alternative to extension repositories of other frameworks.

Please note that the quality and stability of those packages may be different than what you expect from Click itself. While published under a common

organization, they are still projects separate from Click.

.. \_click-contrib: <https://github.com/click-contrib/>

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\* /opt/cola/permits/1298235603\_1649268976.82/0/click-8-1-2-tar-gz/click-8.1.2/docs/contrib.rst

# 1.430 spring-aop 5.2.20.RELEASE

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\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/MethodInvocationProceedingJoinPoint.java

\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/ExposeInvocationInterceptor.java

\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AspectEntry.java

\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/autoproxy/AspectJPrecedenceComparator.java

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\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/autoproxy/AspectJAwareAdvisorAutoProxyCreator.java

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\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AdvisorEntry.java  
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jar/org/springframework/aop/config/SpringConfiguredBeanDefinitionParser.java  
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jar/org/springframework/aop/IntroductionAdvisor.java  
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\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-  
jar/org/springframework/aop/target/PrototypeTargetSource.java  
\* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-  
jar/org/springframework/aop/framework/autoproxy/target/LazyInitTargetSourceCreator.java  
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- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/PerformanceMonitorInterceptor.java
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- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DefaultBeanFactoryPointcutAdvisor.java
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- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/JamonPerformanceMonitorInterceptor.java
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- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/autoproxy/InfrastructureAdvisorAutoProxyCreator.java
- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJExpressionPointcutAdvisor.java
- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/autoproxy/BeanNameAutoProxyCreator.java
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  - \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/BeforeAdvice.java
  - \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AdvisedSupportListener.java
  - \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/AfterAdvice.java
  - \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/SpringProxy.java
  - \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/InterceptorAndDynamicMethodMatcher.java
  - \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/IntroductionInterceptor.java
- No license file was found, but licenses were detected in source scan.

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- \*/

Found in path(s):

- \* /opt/cola/permits/1301486327\_1649248790.73/0/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJWeaverMessageHandler.java

## 1.431 jctools-core 3.0.0

## 1.431.1 Available under license :

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

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">
 <modelVersion>4.0.0</modelVersion>

 <artifactId>jctools-core</artifactId>
 <groupId>org.jctools</groupId>
 <version>3.0.0</version>
 <name>Java Concurrency Tools Core Library</name>
 <description>Java Concurrency Tools Core Library</description>
 <packaging>bundle</packaging>

 <dependencies>
 <dependency>
 <groupId>org.hamcrest</groupId>
 <artifactId>hamcrest-all</artifactId>
 <version>${hamcrest.version}</version>
 <scope>test</scope>
 </dependency>

 <dependency>
 <groupId>junit</groupId>
 <artifactId>junit</artifactId>
 <version>${junit.version}</version>
 <scope>test</scope>
 </dependency>

 <dependency>
 <groupId>com.google.guava</groupId>
 <artifactId>guava-testlib</artifactId>
 <version>${guava-testlib.version}</version>
 <scope>test</scope>
 </dependency>
 </dependencies>
 <build>
 <plugins>
 <plugin>
 <groupId>org.apache.maven.plugins</groupId>
 <artifactId>maven-surefire-plugin</artifactId>
 <version>3.0.0-M3</version>
 <configuration>
 <includes>
 <include>*</include>
 </includes>
 </configuration>
 </plugin>
 </plugins>
 </build>
</project>
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```

<plugin>
 <groupId>org.apache.felix</groupId>
 <artifactId>maven-bundle-plugin</artifactId>
 <version>4.2.1</version>
 <extensions>>true</extensions>
 <configuration>
 <instructions>
 <Import-Package>sun.misc;resolution:=optional</Import-Package>
 </instructions>
 </configuration>
</plugin>
<plugin>
 <groupId>org.apache.maven.plugins</groupId>
 <artifactId>maven-source-plugin</artifactId>
 <version>3.2.0</version>
 <executions>
 <execution>
 <id>attach-sources</id>
 <phase>verify</phase>
 <goals>
 <goal>jar-no-fork</goal>
 </goals>
 </execution>
 </executions>
</plugin>
<plugin>
 <groupId>org.apache.maven.plugins</groupId>
 <artifactId>maven-javadoc-plugin</artifactId>
 <version>3.1.1</version>
 <configuration>
 <additionalOptions>
 <additionalOption>-Xdoclint:none</additionalOption>
 </additionalOptions>
 <source>8</source>
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 <executions>
 <execution>
 <id>attach-javadocs</id>
 <goals>
 <goal>jar</goal>
 </goals>
 </execution>
 </executions>
</plugin>
</plugins>
</build>

<distributionManagement>

```

```
<repository>
 <id>bintray-jctools-jctools</id>
 <name>jctools-jctools</name>
 <url>https://api.bintray.com/maven/jctools/jctools/jctools-core/;publish=1</url>
</repository>
</distributionManagement>
```

```
<url>https://github.com/JCTools</url>
<inceptionYear>2013</inceptionYear>
```

```
<licenses>
 <license>
 <name>Apache License, Version 2.0</name>
 <url>http://www.apache.org/licenses/LICENSE-2.0.txt</url>
 <distribution>repo</distribution>
 </license>
</licenses>
```

```
<scm>
 <url>https://github.com/JCTools/JCTools</url>
 <connection>scm:git:https://github.com/JCTools/JCTools</connection>
 <tag>HEAD</tag>
</scm>
```

```
<developers>
 <developer>
 <url>https://github.com/nitsanw</url>
 </developer>
 <developer>
 <url>https://github.com/mjpt777</url>
 </developer>
 <developer>
 <url>https://github.com/RichardWarburton</url>
 </developer>
 <developer>
 <url>https://github.com/kay</url>
 </developer>
 <developer>
 <url>https://github.com/franz1981</url>
 </developer>
</developers>
```

```
<prerequisites>
 <maven>3.5.0</maven>
</prerequisites>
```

```
<properties>
 <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
```

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<java.version>1.6</java.version>
<java.test.version>1.8</java.test.version>

<maven.compiler.source>${java.version}</maven.compiler.source>
<maven.compiler.target>${java.version}</maven.compiler.target>
<maven.compiler.testSource>${java.test.version}</maven.compiler.testSource>
<maven.compiler.testTarget>${java.test.version}</maven.compiler.testTarget>

<hamcrest.version>1.3</hamcrest.version>
<junit.version>4.12</junit.version>
<guava-testlib.version>21.0</guava-testlib.version>
</properties>
</project>
```

Found in path(s):

\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/META-INF/maven/org.jctools/jctools-core/pom.xml

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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/queues/MessagePassingQueueUtil.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/util/UnsafeJvmInfo.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/queues/atomic/MpscAtomicArrayQueue.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/queues/atomic/MpscLinkedAtomicQueue.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/queues/atomic/MpmcAtomicArrayQueue.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/queues/SpSCGrowArrayQueue.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org.jctools/queues/SpSCArrayQueue.java

- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/ConcurrentAutoTable.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingIdentityHashMap.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscGrowableArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/Pow2.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/ConcurrentQueueSpec.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/BaseLinkedQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/InternalAPI.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpmcUnboundedXaddArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/SpscLinkedQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpscChunkedAtomicArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/Ordering.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/Preference.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/AbstractEntry.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscGrowableAtomicArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/BaseMpscLinkedAtomicArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscLinkedQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/package-info.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/RangeUtil.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/util/PortableJvmInfo.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/QueueFactory.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscChunkedAtomicArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscBlockingConsumerArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/queues/ConcurrentSequencedCircularArrayQueue.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingHashSet.java
- \* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-



jar/org/jctools/queues/IndexedQueueSizeUtil.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
jar/org/jctools/queues/atomic/LinkedQueueAtomicNode.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
jar/org/jctools/queues/SupportsIterator.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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jar/org/jctools/queues/atomic/AtomicReferenceArrayQueue.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
jar/org/jctools/maps/NonBlockingHashMapLong.java  
\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
jar/org/jctools/queues/ConcurrentCircularArrayQueue.java  
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\* /opt/cola/permits/1257637630\_1642977964.98/0/jctools-core-3-0-0-sources-  
jar/org/jctools/queues/atomic/AtomicQueueFactory.java

## 1.432 jackson-module-parameter-names

### 2.11.2

#### 1.432.1 Available under license :

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Version 2.0, January 2004

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```

Constant-time SSSE3 AES core implementation.
version 0.1

By Mike Hamburg (Stanford University), 2009
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Version 3, 29 June 2007

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```
<one line to give the program's name and a brief idea of what it does.>
Copyright (C) <year> <name of author>
```

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```
<program> Copyright (C) <year> <name of author>
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```

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# 1.439 rtmpdump 2.4+20151223.gitfa8646d.1-2build1

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Version 2.1, February 1999

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```
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```

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# 1.441 open-vm-tools 9.4.0

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## 1.444 tcpdump 4.9.2

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```
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```
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```

<signature of Ty Coon>, 1 April 1989

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The End

## 1.448 libiconv 1.14

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Version 3, 29 June 2007

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



treats it as such.

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

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

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

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for

making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the

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

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

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

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

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work

during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)
- b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on

the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

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Version 3, 29 June 2007

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Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

## TERMS AND CONDITIONS

### 0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

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#### 1. Source Code.

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

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

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

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c) You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

d) If the work has interactive user interfaces, each must display Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

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b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this

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e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

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\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourceType.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/copy/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/WriteBehindConfiguration.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/persistence/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/event/EventType.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/PersistentUserManagedCache.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourcePool.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/EvictionAdvisor.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/CacheIterationException.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/PluralService.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/event/CacheEventListener.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourceUnit.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/Builder.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/BulkCacheWritingException.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/Cache.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/units/MemoryUnit.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/ResilienceStrategyProvider.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterProvider.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/event/EventFiring.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/UserManagedCache.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/Duration.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourcePools.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/WriteBehindProvider.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/event/CacheEvent.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/CacheRuntimeConfiguration.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriter.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceCreationConfiguration.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/copy/CopyProvider.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceProvider.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/PersistentCacheManager.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/StatefulSerializer.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/UnsupportedTypeException.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/FluentCacheConfigurationBuilder.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/package-info.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceConfiguration.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/CachePersistenceException.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/config/units/EntryUnit.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/Serializer.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-jar/org/ehcache/spi/persistence/StateRepository.java

\* /opt/cola/permits/1258059202\_1643027219.24/0/ehcache-api-3-8-1-sources-

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An entry with multiple email addresses specifies that the
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Please keep the list sorted.

Aamir Khan <syst3m.w0rm@gmail.com>
Aaron Beitch <aaronb@arista.com>
Aaron Bieber <deftly@gmail.com>
Aaron Cannon <cannona@fireantproductions.com>
Aaron France <aaron.l.france@gmail.com>
Aaron Jacobs <jacobsa@google.com>
Aaron Kemp <kemp.aaron@gmail.com>
Aaron Patterson <tenderlove@ruby-lang.org>
Aaron Stein <aaronstein12@gmail.com>
Aaron Torres <tcboox@gmail.com>
Aaron Zinman <aaron@azinman.com>
Aarti Parikh <aarti.parikh@gmail.com>
Abdullah Al Maruf <mymail.maruf@gmail.com>
Abe Haskins <abeisgreat@abeisgreat.com>
Abhinav Gupta <abhinav.g90@gmail.com>
Adam Azarchs <adam.azarchs@10xgenomics.com>
```



Adam Bender <abender@google.com>  
Adam Eijdenberg <adam@continusec.com>  
Adam Harvey <aharvey@php.net>  
Adam Kisala <adam.kisala@gmail.com>  
Adam Langley <agl@golang.org>  
Adam Medzinski <adam.medzinski@gmail.com>  
Adam Shannon <adamkshannon@gmail.com>  
Adam Shelton <aashelt90@gmail.com>  
Adam Sindelar <adamsh@google.com>  
Adam Thomason <athomason@gmail.com>  
Adam Williams <pwnfactory@gmail.com>  
Adam Woodbeck <adam@woodbeck.net>  
Adarsh Ravichandran <adarshravichandran91@gmail.com>  
Aditya Harindar <aditya.harindar@gmail.com>  
Aditya Mukerjee <dev@chimeracoder.net>  
Adrian Hesketh <adrianhesketh@hushmail.com>  
Adrian Nos <nos.adrian@gmail.com>  
Adrian O'Grady <elpollouk@gmail.com>  
Adrien Bustany <adrien-xx-google@bustany.org>  
Adrien Delorme <adrien.delorme@icloud.com>  
Adrien Petel <peteladrien@gmail.com>  
Acio Jnior <aeciodantasjunior@gmail.com>  
Aeneas Rekkas (arekkas) <aeneas@ory.am>  
Afanasev Stanislav <phpprogger@gmail.com>  
Agis Anastasopoulos <agis.anast@gmail.com>  
Agniva De Sarker <agnivade@yahoo.co.in>  
Ahmed Wahed <oneofone@gmail.com>  
Ahmet Alp Balkan <ahmetb@google.com>  
Ahmet Soormally <ahmet@mangomm.co.uk>  
Ahmy Yulrizka <yulrizka@gmail.com>  
Ahsun Ahmed <ahmed.ahsun@gmail.com>  
Aiden Scandella <ai@uber.com>  
Ainar Garipov <gugl.zadolbal@gmail.com>  
Aishraj Dahal <aishraj@users.noreply.github.com>  
Akhil Indurti <aindurti@gmail.com>  
Akihiro Suda <suda.kyoto@gmail.com>  
Akshat Kumar <seed@mail.nanosouffle.net>  
Al Cutter <al@google.com>  
Alan Braithwaite <alan@ipaddr.org>  
Alan Donovan <adonovan@google.com>  
Alan Shreve <alan@inconshreveable.com>  
Albert Nigmatzianov <albertnigma@gmail.com>  
Albert Strasheim <fullung@gmail.com>  
Albert Teoh <albert.teoh@gmail.com>  
Albert Yu <yukinying@gmail.com>  
Alberto Bertogli <albertito@blitiri.com.ar>  
Alberto Donizetti <alb.donizetti@gmail.com>  
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>

Alec Benzer <alec.benzer@gmail.com>  
Aleksa Sarai <cyphar@cyphar.com>  
Aleksandar Dezelin <dezelin@gmail.com>  
Aleksandr Lukinykh <a.lukinykh@xsolla.com>  
Aleksandr Razumov <ar@cydev.ru>  
Alekseev Artem <a.artem060@gmail.com>  
Alessandro Arzilli <alessandro.arzilli@gmail.com>  
Alessandro Baffa <alessandro.baffa@gmail.com>  
Alex A Skinner <alex@lx.lc>  
Alex Brainman <alex.brainman@gmail.com>  
Alex Bramley <abramley@google.com>  
Alex Browne <stephenalexbrowne@gmail.com>  
Alex Buchanan <buchanae@gmail.com>  
Alex Carol <alex.carol.c@gmail.com>  
Alex Gaynor <alex@alloy.us>  
Alex Harford <alex.harford@saucelabs.com>  
Alex Jin <toalexjin@gmail.com>  
Alex Kohler <alexjohnkohler@gmail.com>  
Alex Myasoedov <msoedov@gmail.com>  
Alex Plugaru <alex@plugaru.org> <alexandru.plugaru@gmail.com>  
Alex Schroeder <alex@gnu.org>  
Alex Sergeev <abc@alexsergeev.com>  
Alex Tokarev <aleksator@gmail.com>  
Alex Vaghin <crhyme@google.com>  
Alex Zhirov <azhirov@google.com>  
Alexander Demakin <alexander.demakin@gmail.com>  
Alexander Dring <email@alex.d.ch>  
Alexander F Rdseth <alexander.rodseth@appeartv.com>  
Alexander Greim <alexxx@iltempo.de>  
Alexander Guz <kalimatas@gmail.com>  
Alexander Kauer <alexander@affine.space>  
Alexander Kucherenko <alxkchr@gmail.com>  
Alexander Larsson <alexander.larsson@gmail.com>  
Alexander Lourier <aml@rulezz.ru>  
Alexander Menzhinsky <amenzhinsky@gmail.com>  
Alexander Morozov <lk4d4math@gmail.com>  
Alexander Neumann <alexander@bumper.de>  
Alexander Nohe <alex.nohe427@gmail.com>  
Alexander Orlov <alexander.orlov@loxal.net>  
Alexander Pantyukhin <apantykhin@gmail.com>  
Alexander Polcyn <apolcyn@google.com>  
Alexander Rakoczy <alex@golang.org>  
Alexander Reece <awreece@gmail.com>  
Alexander Surma <surma@surmair.de>  
Alexander Zhavnerchik <alex.vizor@gmail.com>  
Alexander Zillion <alex@alexzillion.com>  
Alexander Zolotov <goldifit@gmail.com>  
Alexandr Mayorskiy <a.mayorskiy@corp.mail.ru>

Alexandre Cesaro <alexandre.cesaro@gmail.com>  
Alexandre Fiori <fiorix@gmail.com>  
Alexandre Maari <draeron@gmail.com>  
Alexandre Normand <alexandre.normand@gmail.com>  
Alexandre Parentea <aubonbeurre@gmail.com>  
Alexandre Viau <alexandre@alexandreviau.net>  
Alexandru Mooi <brtznr@gmail.com>  
Alexei Sholik <alcosholik@gmail.com>  
Alexey Alexandrov <aalexand@google.com>  
Alexey Borzenkov <snaury@gmail.com>  
Alexey Naidonov <alexey.naidyonov@gmail.com>  
Alexey Neganov <neganovalexey@gmail.com>  
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>  
Alexey Semenyuk <alexsemenyuk88@gmail.com>  
Alexis Hildebrandt <surryhill@gmail.com>  
Alexis Hunt <lexer@google.com>  
Alexis Imperial-Legrand <ail@google.com>  
Ali Farooq <ali.farooq0@pm.me>  
Ali Rizvi-Santiago <arizvisa@gmail.com>  
Aliaksandr Valialkin <valyala@gmail.com>  
Alif Rachmawadi <subosito@gmail.com>  
Allan Simon <allan.simon@supinfo.com>  
Allen Li <ayatane@google.com>  
Alok Menghrajani <alok.menghrajani@gmail.com>  
Aman Gupta <aman@tmm1.net>  
Amarjeet Anand <amarjeetanandsingh@gmail.com>  
Amir Mohammad Saied <amir@gluegadget.com>  
Amr Mohammed <merodiro@gmail.com>  
Amrut Joshi <amrut.joshi@gmail.com>  
An Long <aisk1988@gmail.com>  
An Xiao <hac@zju.edu.cn>  
Anand K. Mistry <anand@mistry.ninja>  
Anders Pearson <anders@columbia.edu>  
Anderson Queiroz <contato@andersonq.eti.br>  
Andr Carvalho <asantostc@gmail.com>  
Andr Martins <aanm90@gmail.com>  
Andre Nathan <andrenth@gmail.com>  
Andrea Nodari <andrea.nodari91@gmail.com>  
Andrea Spadaccini <spadaccio@google.com>  
Andreas Auernhammer <aead@mail.de>  
Andreas Jellinghaus <andreas@ionisiert.de> <anj@google.com>  
Andreas Litt <andreas.litt@gmail.com>  
Andrei Enshin <b1os@bk.ru>  
Andrei Gherzan <andrei@resin.io>  
Andrei Korzhevskii <a.korzhevskiy@gmail.com>  
Andrei Matei <andrei@cockroachlabs.com>  
Andrei Tudor Clin <mail@acln.ro>  
Andrei Vagin <avagin@google.com>

Andrei Vieru <euvieru@gmail.com>  
Andres Erbsen <andreser@google.com>  
Andres Lowrie <andres.lowrie@gmail.com>  
Andrew Austin <andrewaact@gmail.com>  
Andrew Balholm <andybalholm@gmail.com>  
Andrew Benton <andrewmbenton@gmail.com>  
Andrew Bonventre <andybons@chromium.org>  
Andrew Braunstein <awbraunstein@gmail.com>  
Andrew Bursavich <abursavich@gmail.com>  
Andrew Ekstedt <andrew.ekstedt@gmail.com>  
Andrew Etter <andrew.etter@gmail.com>  
Andrew G. Morgan <agm@google.com>  
Andrew Gerrand <adg@golang.org>  
Andrew Harding <andrew@spacemonkey.com>  
Andrew Jackura <ajackura@google.com>  
Andrew Louis <alouis@digitalocean.com>  
Andrew Lutomirski <andy@luto.us>  
Andrew Medvedev <andrew.y.medvedev@gmail.com>  
Andrew Pilloud <andrewpilloud@igneoussystems.com>  
Andrew Pogrebnoy <absourd.noise@gmail.com>  
Andrew Poydence <apoydence@pivotal.io>  
Andrew Pritchard <awpritchard@gmail.com>  
Andrew Radev <andrey.radev@gmail.com>  
Andrew Skiba <skibaa@gmail.com>  
Andrew Stormont <astormont@racktopsystems.com>  
Andrew Stribblehill <ads@wompom.org>  
Andrew Szeto <andrew@jabagawee.com>  
Andrew Todd <andrew.todd@wework.com>  
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>  
Andrew Wilkins <axwalk@gmail.com>  
Andrew Williams <williams.andrew@gmail.com>  
Andrew Z Allen <me@andrewzallen.com>  
Andrey Mirtchovski <mirtchovski@gmail.com>  
Andrey Petrov <andrey.petrov@shazow.net>  
Andrii Soldatenko <andrii.soldatenko@gmail.com>  
Andrii Soluk <isoluchok@gmail.com>  
Andriy Lytvynov <lytvynov.a.v@gmail.com>  
Andrzej eel <andrii.zhezhel@gmail.com>  
Andy Balholm <andy@balholm.com>  
Andy Davis <andy@bigandian.com>  
Andy Finkenstadt <afinkenstadt@zynga.com>  
Andy Lindeman <andy@lindeman.io>  
Andy Maloney <asmaloney@gmail.com>  
Andy Pan <panjf2000@gmail.com>  
Andy Walker <walkeraj@gmail.com>  
Andy Wang <cbeuw.andy@gmail.com>  
Andzej Maciusovic <andzej.maciusovic@gmail.com>  
Anfernee Yongkun Gui <anfernee.gui@gmail.com>

Angelo Bulfone <mbulfone@gmail.com>  
Anh Hai Trinh <anh.hai.trinh@gmail.com>  
Anit Gandhi <anitgandhi@gmail.com>  
Ankit Goyal <ankit3goyal@gmail.com>  
Anmol Sethi <anmol@aubble.com>  
Annirudh Prasad <annirudh@wandb.com>  
Anschel Schaffer-Cohen <anschelsc@gmail.com>  
Anthony Alves <cvballa3g0@gmail.com>  
Anthony Canino <anthony.canino1@gmail.com>  
Anthony Eufemio <anthony.eufemio@gmail.com>  
Anthony Fok <foka@debian.org>  
Anthony Martin <ality@pbrane.org>  
Anthony Sottile <asottile@umich.edu>  
Anthony Starks <ajstarks@gmail.com>  
Anthony Voutas <voutasaurus@gmail.com>  
Anthony Woods <awoods@raintank.io>  
Antoine GIRARD <sapk@sapk.fr>  
Antoine Martin <antoine97.martin@gmail.com>  
Anton Gyllenberg <anton@iki.fi>  
Anton Kuklin <anton.a.kuklin@gmail.com>  
Antonin Amand <antonin.amand@gmail.com>  
Antonio Antelo <aantelov87@gmail.com>  
Antonio Bibiano <antbbn@gmail.com>  
Antonio Huete Jimenez <tuxillo@quantumachine.net>  
Antonio Murdaca <runcom@redhat.com>  
Antonio Troina <thoeni@gmail.com>  
Anze Kolar <me@akolar.com>  
Aofei Sheng <aofei@aofeisheng.com>  
Apisak Darakananda <pongad@gmail.com>  
Aram Hvrneanu <aram@mgk.ro>  
Araragi Hokuto <kanseihonbucho@protonmail.com>  
Arash Bina <arash@arash.io>  
Arda Gl <ardaguclu@gmail.com>  
Areski Belaid <areski@gmail.com>  
Ariel Mashraki <ariel@mashraki.co.il>  
Arkadi Pyuro <arkadi@google.com>  
Arlo Breault <arlolra@gmail.com>  
Arnaud Ysmal <arnaud.ysmal@gmail.com>  
Arne Hormann <arnehormann@gmail.com>  
Arnout Engelen <arnout@bzzt.net>  
Aron Nopanen <aron.nopanen@gmail.com>  
Artem Alekseev <artem.alekseev@intel.com>  
Artem Kolin <artemkaxboy@gmail.com>  
Arthur Fabre <arthur@arthurfabre.com>  
Arthur Khashaev <arthur@khashaev.ru>  
Artyom Pervukhin <artyom.pervukhin@gmail.com>  
Arvindh Rajesh Tamilmani <art@a-30.net>  
Ashish Gandhi <ag@ashishgandhi.org>

Asim Shankar <asimshankar@gmail.com>  
Atin Malaviya <amalaviy@akamai.com>  
Ato Araki <ato.araki@gmail.com>  
Audrey Lim <audreylh@gmail.com>  
Audrius Butkevicius <audrius.butkevicius@gmail.com>  
Augusto Roman <aroman@gmail.com>  
Aulus Egnatius Varialus <varialus@gmail.com>  
Aurlien Rainone <aurelien.rainone@gmail.com>  
Aurlio A. Heckert <aurium@gmail.com>  
Austin Clements <austin@google.com> <aclements@csail.mit.edu>  
Avi Flax <avi@timehop.com>  
awaw fumin <awawfumin@gmail.com>  
Awn Umar <awn@cryptolosophy.io>  
Axel Wagner <axel.wagner.hh@googlemail.com>  
Ayan George <ayan@ayan.net>  
Ayanamist Yang <ayanamist@gmail.com>  
Ayke van Laethem <aykevanlaethem@gmail.com>  
Aymerick Jhanne <aymerick@jehanne.org>  
Azat Kaumov <kaumov.a.r@gmail.com>  
Baiju Muthukadan <baiju.m.mail@gmail.com>  
Balaram Makam <bmakam.qdt@qualcommdatacenter.com>  
Balazs Lecz <leczb@google.com>  
Baokun Lee <nototon@gmail.com>  
Barnaby Keene <accounts@southcla.ws>  
Bartosz Grzybowski <melkorm@gmail.com>  
Bartosz Oler <brtsz@google.com>  
Bastian Ike <bastian.ike@gmail.com>  
Ben Burkert <ben@benburkert.com>  
Ben Eitzen <eitzenb@golang.org>  
Ben Fried <ben.fried@gmail.com>  
Ben Haines <bhainesva@gmail.com>  
Ben Hoyt <benhoyt@gmail.com>  
Ben Laurie <ben@links.org> <benl@google.com>  
Ben Lubar <ben.lubar@gmail.com>  
Ben Lynn <benlynn@gmail.com>  
Ben Olive <sionide21@gmail.com>  
Ben Schwartz <bemasc@google.com>  
Ben Shi <powerman1st@163.com>  
Ben Toews <mastahyeti@gmail.com>  
Benjamin Black <b@b3k.us>  
Benjamin Cable <cable.benjamin@gmail.com>  
Benjamin Hsieh <tanookiben@users.noreply.github.com>  
Benjamin Peterson <benjamin@python.org>  
Benjamin Prosnitz <bprosnitz@google.com>  
Benjamin Wester <bwester@squareup.com>  
Benjamin Wuethrich <benjamin.wuethrich@gmail.com>  
Benny Siegert <bsiegert@gmail.com>  
Benoit Sigoure <tsunanet@gmail.com>

Berengar Lehr <Berengar.Lehr@gmx.de>  
Berkant Ipek <41230766+0xbkt@users.noreply.github.com>  
Bharath Thiruveedula <tbharath91@gmail.com>  
Bhavin Gandhi <bhavin7392@gmail.com>  
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>  
Bill O'Farrell <billo@ca.ibm.com>  
Bill Prin <waprin@google.com>  
Bill Thiede <couchmoney@gmail.com>  
Bill Zissimopoulos <billziss@navimatics.com>  
Billie Harold Cleek <bhcleek@gmail.com>  
Billy Lynch <wlynch@google.com>  
Billy Zaelani Malik <m.billyzaelani@gmail.com>  
Bjrn Erik Pedersen <bjorn.erik.pedersen@gmail.com>  
Bjorn Tillenius <bjorn@tillenius.me>  
Bjorn Tipling <bjorn.tipling@gmail.com>  
Blain Smith <rebelgeek@blainsmith.com>  
Blake Gentry <blakesgentry@gmail.com>  
Blake Mesdag <blakemesdag@gmail.com>  
Blake Mizerany <blake.mizerany@gmail.com>  
Blixt <me@blixt.nyc>  
Bob Briski <rbriski@gmail.com>  
Bob McNaughton <bobmcn@gmail.com>  
Bob Potter <bobby.potter@gmail.com>  
Bobby DeSimone <bobbydesimone@gmail.com>  
Bobby Powers <bobbypowers@gmail.com>  
Boqin Qin <bobbqqin@gmail.com>  
Boris Nagaev <nagaev@google.com>  
Borja Clemente <borja.clemente@gmail.com>  
Brad Burch <brad.burch@gmail.com>  
Brad Erickson <bderickson@gmail.com>  
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>  
Brad Garcia <bgarcia@golang.org>  
Brad Jones <rbjones@google.com>  
Brad Morgan <brad@morgabra.com>  
Brad Whitaker <bwhitaker@fastly.com>  
Braden Bassingthwaite <bbassingthwaite@vendasta.com>  
Bradford Lamson-Scribner <brad.lamson@gmail.com>  
Bradley Falzon <brad@teambrad.net>  
Brady Catherman <brady@gmail.com>  
Brady Sullivan <brady@bsull.com>  
Brandon Bennett <bbennett@fb.com>  
Brandon Gilmore <varz@google.com>  
Brandon Philips <brandon@ifup.org>  
Brandon Ryan <bjryan19@gmail.com>  
Brayden Cloud <bcloud@google.com>  
Brendan Daniel Tracey <tracey.brendan@gmail.com>  
Brendan O'Dea <bod@golang.org>  
Brett Cannon <bcannon@gmail.com>

Brett Merrill <brett.j.merrill94@gmail.com>  
Brian Dellisanti <briandellisanti@gmail.com>  
Brian Downs <brian.downs@gmail.com>  
Brian Falk <falk@logicparty.org>  
Brian G. Merrell <bgmerrell@gmail.com>  
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>  
Brian Kennedy <btkennedy@gmail.com>  
Brian Kessler <brian.m.kessler@gmail.com>  
Brian Ketelsen <bketelsen@gmail.com>  
Brian Slesinsky <skybrian@google.com>  
Brian Smith <ohohvi@gmail.com>  
Brian Starke <brian.starke@gmail.com>  
Bryan Alexander <Kozical@msn.com>  
Bryan C. Mills <bcmills@google.com>  
Bryan Chan <bryan.chan@ca.ibm.com>  
Bryan Ford <brynosaurus@gmail.com>  
Bryan Heden <b.heden@gmail.com>  
Bulat Gaifullin <gaifullinbf@gmail.com>  
Burak Guven <bguven@gmail.com>  
Caine Tighe <arctanofyourface@gmail.com>  
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>  
Caleb Martinez <accounts@calebmartinez.com>  
Caleb Spare <cespare@gmail.com>  
Carl Chatfield <carlchatfield@gmail.com>  
Carl Henrik Lunde <chlunde@ifi.uio.no>  
Carl Jackson <carl@stripe.com>  
Carl Johnson <me@carlmjohnson.net>  
Carl Mastrangelo <notcarl@google.com>  
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>  
Carlisia Campos <carlisia@grokkingtech.io>  
Carlo Alberto Ferraris <cafxx@strayorange.com>  
Carlos Amedee <carlos@golang.org>  
Carlos Castillo <cookieo9@gmail.com>  
Carlos Cirello <uldericofilho@gmail.com>  
Carlos Eduardo <me@carlosedp.com>  
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>  
Carlos Iriarte <ciriarte@gmail.com>  
Carlos Souza <carloshrsouza@gmail.com>  
Carolyn Van Slyck <me@carolynvanslyck.com>  
Carrie Bynon <cbynon@gmail.com>  
Cary Hull <chull@google.com>  
Case Nelson <case.nelson@gmail.com>  
Casey Callendrello <squeed@gmail.com>  
Casey Marshall <casey.marshall@gmail.com>  
Catalin Nicutar <cnicutar@google.com>  
Catalin Patulea <catalinp@google.com>  
Cedric Staub <cs@squareup.com>  
Cezar S Espinola <cezarsa@gmail.com>



Chad Rosier <mrosier.qdt@qualcommdatacenter.com>  
ChaiShushan <chaishushan@gmail.com>  
Changkun Ou <hi@changkun.us>  
Channing Kimble-Brown <channing@golang.org>  
Chao Xu <xuchao@google.com>  
Charles Fenwick Elliott <Charles@FenwickElliott.io>  
Charles Kenney <charlesc.kenney@gmail.com>  
Charles L. Dorian <cldorian@gmail.com>  
Charles Lee <zombie.fml@gmail.com>  
Charles Weill <weill@google.com>  
Chauncy Cullitan <chauncyc@google.com>  
Chen Zhihan <energiehund@gmail.com>  
Cherry Zhang <cherryyz@google.com>  
Chew Choon Keat <choonkeat@gmail.com>  
Cholerae Hu <choleraehyq@gmail.com>  
Chotepud Teo <AlexRouSg@users.noreply.github.com>  
Chris Ball <chris@printf.net>  
Chris Biscardi <chris@christopherbiscardi.com>  
Chris Broadfoot <cbro@golang.org>  
Chris Dollin <ehog.hedge@gmail.com>  
Chris Farmiloe <chrisfarms@gmail.com>  
Chris Hines <chris.cs.guy@gmail.com>  
Chris Howey <howeyc@gmail.com>  
Chris Hundt <hundt@google.com>  
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>  
Chris Kastorff <encryptio@gmail.com>  
Chris Le Roy <brompwnie@users.noreply.github.com>  
Chris Lennert <calennert@gmail.com>  
Chris Liles <caveryliles@gmail.com>  
Chris Manghane <cmang@golang.org>  
Chris Marchesi <chrism@vanclueverttech.com>  
Chris McGee <sirnewton\_01@yahoo.ca> <newton688@gmail.com>  
Chris Raynor <raynor@google.com>  
Chris Roche <rodaine@gmail.com>  
Chris Smith <chrsmith@users.noreply.github.com>  
Chris Stockton <chrisstocktonaz@gmail.com>  
Chris Zou <chriszou@ca.ibm.com>  
Christian Alexander <christian@linux.com>  
Christian Couder <chriscool@tuxfamily.org>  
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>  
Christian Muehlhaeuser <muesli@gmail.com>  
Christian Pellegrin <chri@evolware.org>  
Christian R. Petrin <christianpetrin@gmail.com>  
Christine Hansmann <chhansmann@gmail.com>  
Christoffer Buchholz <christoffer.buchholz@gmail.com>  
Christoph Blecker <admin@toph.ca>  
Christoph Hack <christoph@tux21b.org>  
Christopher Cahoon <chris.cahoon@gmail.com>

Christopher Guiney <chris@guiney.net>  
Christopher Henderson <chris@chenderson.org>  
Christopher Koch <chrisko@google.com>  
Christopher Loessl <cloessl+github@gmail.com>  
Christopher Nelson <nadiasvertex@gmail.com>  
Christopher Nielsen <m4dh4tt3r@gmail.com>  
Christopher Redden <christopher.redden@gmail.com>  
Christopher Swenson <cswenson@google.com>  
Christopher Wedgwood <cw@f00f.org>  
Christos Zoulas <christos@zoulas.com> <zoulasc@gmail.com>  
Christy Perez <christy@linux.vnet.ibm.com>  
CL Sung <clsung@gmail.com> <cl\_sung@htc.com>  
Clement Chigot <clement.chigot@atos.net>  
Clement Skau <clementskaug@gmail.com>  
Clint J. Edwards <clint.j.edwards@gmail.com>  
Cody Oss <the.cody.oss@gmail.com>  
Colby Ranger <cranger@google.com>  
Colin Arnott <colin@urandom.co.uk>  
Colin Cross <ccross@android.com>  
Colin Edwards <colin@recursivepenguin.com>  
Colin Kennedy <moshen.colin@gmail.com>  
Colin Nelson <colnnelson@google.com>  
Colin Rice <clr@google.com>  
Conrad Irwin <conrad.irwin@gmail.com>  
Conrad Meyer <cemeyer@cs.washington.edu>  
Conrado Gouvea <conradopl@gmail.com>  
Constantin Konstantinidis <constantinkonstantinidis@gmail.com>  
Corey Thomasson <cthom.lists@gmail.com>  
Corne van der Plas <vdplas@gmail.com>  
Cosmos Nicolaou <cnicolaou@google.com>  
Costin Chirvasuta <ctin@google.com>  
Craig Citro <craigcitro@google.com>  
Cristian Staretu <unclejacksons@gmail.com>  
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>  
Cyrill Schumacher <cyrrill@schumacher.fm>  
Daisuke Fujita <dtanshi45@gmail.com>  
Daisuke Suzuki <daisuzu@gmail.com>  
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>  
Damian Gryski <dgryski@gmail.com>  
Damien Lespiau <damien.lespiau@gmail.com> <damien.lespiau@intel.com>  
Damien Mathieu <42@dmathieu.com>  
Damien Neil <dneil@google.com>  
Damien Tournoud <damien@platform.sh>  
Dan Ballard <dan@mindstab.net>  
Dan Caddigan <goldcaddy77@gmail.com>  
Dan Callahan <dan.callahan@gmail.com>  
Dan Harrington <harringtond@google.com>  
Dan Jacques <dnj@google.com>

Dan Johnson <computerdruid@google.com>  
Dan Peterson <dpiddy@gmail.com>  
Dan Pupius <dan@medium.com>  
Dan Scales <danscales@google.com>  
Dan Sinclair <dan.sinclair@gmail.com>  
Daniel Cormier <danielc@knowbe4.com>  
Danil de Kok <me@danieldk.eu>  
Daniel Fleischman <danielfleischman@gmail.com>  
Daniel Ingram <ingramds@appstate.edu>  
Daniel Johansson <dajo2002@gmail.com>  
Daniel Kerwin <d.kerwin@gini.net>  
Daniel Krech <eikeon@eikeon.com>  
Daniel Kumor <rdkumor@gmail.com>  
Daniel Langner <s8572327@gmail.com>  
Daniel Lidn <daniel.liden.87@gmail.com>  
Daniel Lublin <daniel@lublin.se>  
Daniel Mangum <georgedanielmangum@gmail.com>  
Daniel Mart <mvdan@mvdan.cc>  
Daniel Morsing <daniel.morsing@gmail.com>  
Daniel Nadasi <dnadasi@google.com>  
Daniel Nephin <dnephin@gmail.com>  
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>  
Daniel Skinner <daniel@dasa.cc>  
Daniel Speichert <daniel@speichert.pl>  
Daniel Theophanes <kardianos@gmail.com>  
Daniel Upton <daniel@floppy.co>  
Daniela Petruzalek <daniela.petruzalek@gmail.com>  
Danish Dua <danishdua@google.com>  
Danish Prakash <grafitykoncept@gmail.com>  
Danny Rosseau <daniel.rosseau@gmail.com>  
Daria Koliustratova <daria.koliustratova@intel.com>  
Darien Raymond <admin@v2ray.com>  
Darren Elwood <darren@textnode.com>  
Darren Grant <darren.e.grant@gmail.com>  
Darren McCleary <darren.rmc@gmail.com>  
Darshan Parajuli <parajulidarshan@gmail.com>  
Datong Sun <dndx@idndx.com>  
Dave Borowitz <dborowitz@google.com>  
Dave Bort <dbort@golang.org>  
Dave Cheney <dave@cheney.net>  
Dave Day <djd@golang.org>  
Dave Grijalva <dgrijalva@ngmoco.com>  
Dave MacFarlane <driusan@gmail.com>  
Dave Russell <forfuncsake@gmail.com>  
David Anderson <danderson@google.com>  
David Barnett <dbarnett@google.com>  
David Benjamin <davidben@google.com>  
David Bond <davidsbond93@gmail.com>

David Brophy <dave@brophy.uk>  
David Brgin <676c7473@gmail.com>  
David Calavera <david.calavera@gmail.com>  
David Carlier <devnexen@gmail.com>  
David Carter <fresco.raja@gmail.com>  
David Chase <drchase@google.com>  
David Covert <davidhcovert@gmail.com>  
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>  
David du Colombier <0intro@gmail.com>  
David Finkel <david.finkel@gmail.com>  
David Forsythe <dforsythe@gmail.com>  
David G. Andersen <dave.andersen@gmail.com>  
David Glasser <glasser@meteor.com>  
David Golden <david@autopragmatic.com>  
David Heuschmann <heuschmann.d@gmail.com>  
David Howden <dhowden@gmail.com>  
David Hubbard <dsp@google.com>  
David Jakob Fritz <david.jakob.fritz@gmail.com>  
David Jones <dxjones@gmail.com>  
David Lazar <lazard@golang.org>  
David Leon Gil <coruus@gmail.com>  
David McLeish <davemc@google.com>  
David Ndungu <dnjuguna@gmail.com>  
David NewHamlet <david@newhamlet.com>  
David Presotto <presotto@gmail.com>  
David R. Jenni <david.r.jenni@gmail.com>  
David Sansome <me@davidsansome.com>  
David Stainton <dstainton415@gmail.com>  
David Symonds <dsymonds@golang.org>  
David Thomas <davidthomas426@gmail.com>  
David Timm <dtimm@pivotal.io>  
David Titarenco <david.titarenco@gmail.com>  
David Tolpin <david.tolpin@gmail.com>  
David Url <david@urld.io>  
David Volquartz Lebech <david@lebech.info>  
David Wimmer <davidlwimmer@gmail.com>  
Davies Liu <davies.liu@gmail.com>  
Davor Kapsa <davor.kapsa@gmail.com>  
Dean Eigenmann <7621705+decanus@users.noreply.github.com>  
Dean Prichard <dean.prichard@gmail.com>  
Deepak Jois <deepak.jois@gmail.com>  
Denis Bernard <db047h@gmail.com>  
Denis Brandolini <denis.brandolini@gmail.com>  
Denis Isaev <idenx@yandex.com>  
Denis Nagorny <denis.nagorny@intel.com>  
Dennis Kuhnert <mail.kuhnert@gmail.com>  
Denys Honsiorovskiy <honsiorovskiy@gmail.com>  
Denys Smirnov <denis.smirnov.91@gmail.com>

Derek Buitenhuis <derek.buitenhuis@gmail.com>  
Derek Che <drc@yahoo-inc.com>  
Derek McGowan <derek@mcgstyle.net>  
Derek Parker <parkerderek86@gmail.com>  
Derek Phan <derekphan94@gmail.com>  
Derek Shockey <derek.shockey@gmail.com>  
Dev Ojha <dojha12@gmail.com>  
Dev Zhoujun <dev.zhoujun@gmail.com>  
Devon H. O'Dell <devon.odell@gmail.com>  
Dhaivat Pandit <dhaivatpandit@gmail.com>  
Dhananjay Nakrani <dhananjayn@google.com>  
Dhiru Kholia <dhiru.kholia@gmail.com>  
Dhruvdudd Jadhav <dhrvdudd.jadhav@gmail.com>  
Di Xiao <dixiao@google.com>  
Didier Spezia <didier.06@gmail.com>  
Diego Siqueira <diego9889@gmail.com>  
Dieter Plaetinck <dieter@raintank.io>  
Dimitri Sokolyuk <sokolyuk@gmail.com>  
Dimitri Tcaciuc <dtcaciuc@gmail.com>  
Dina Garmash <dgrmsh@gmail.com>  
Diogo Pinela <diogoid7400@gmail.com>  
Dirk Gadsden <dirk@esherido.com>  
Diwaker Gupta <diwakergupta@gmail.com>  
Dmitri Goutnik <dgoutnik@gmail.com>  
Dmitri Popov <operator@cv.dp-net.com>  
Dmitri Shuralyov <dmitshur@golang.org> <dmitri@shuralyov.com>  
Dmitriy Cherchenko <dcherchenko@gmail.com>  
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>  
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>  
Dmitriy Vyukov <dvyukov@google.com>  
Dmitry Chestnykh <dchest@gmail.com>  
Dmitry Doroginin <doroginin@gmail.com>  
Dmitry Mottl <dmitry.mottl@gmail.com>  
Dmitry Neverov <dmitry.neverov@gmail.com>  
Dmitry Savintsev <dsavints@gmail.com>  
Dmitry Yakunin <nonamezeil@gmail.com>  
Doga Fincan <doga@icloud.com>  
Domas Tamauskas <puerdomus@gmail.com>  
Domen Ipavec <domen@ipavec.net>  
Dominic Green <dominicgreen1@gmail.com>  
Dominik Honnef <dominik.honnef@gmail.com>  
Dominik Vogt <vogt@linux.vnet.ibm.com>  
Don Byington <don@dbyington.com>  
Donald Huang <don.hcd@gmail.com>  
Dong-hee Na <donghee.na92@gmail.com>  
Donovan Hide <donovanhide@gmail.com>  
Doug Anderson <douga@google.com>  
Doug Fawley <dfawley@google.com>

Douglas Danger Manley <doug.manley@gmail.com>  
Drew Flower <drewvanstone@gmail.com>  
Drew Hintz <adhintz@google.com>  
Duco van Amstel <duco.vanamstel@gmail.com>  
Duncan Holm <mail@frou.org>  
Dustin Carlino <dcarlino@google.com>  
Dustin Herbison <djherbis@gmail.com>  
Dustin Long <dustmop@gmail.com>  
Dustin Sallings <dsallings@gmail.com>  
Dustin Shields-Cloues <dcloues@gmail.com>  
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>  
Dylan Waits <dylan@waits.io>  
Ed Schouten <ed@nuxi.nl>  
Edan Bedrik <3d4nb3@gmail.com>  
Eddie Scholtz <escholtz@google.com>  
Eden Li <eden.li@gmail.com>  
Eduard Urbach <e.urbach@gmail.com>  
Eduardo Ramalho <eduardo.ramalho@gmail.com>  
Eduardo Villaseor <evillasrmx@gmail.com>  
Edward Muller <edwardam@interlix.com>  
Egon Elbre <egonelbre@gmail.com>  
Ehren Kret <ehren.kret@gmail.com>  
Eitan Adler <lists@eitanadler.com>  
Eivind Uggedal <eivind@uggedal.com>  
Elbert Fliek <efliek@gmail.com>  
Eldar Rakhimberdin <ibeono@gmail.com>  
Elena Grahovac <elena@grahovac.me>  
Eli Bendersky <eliben@google.com>  
Elias Naur <mail@eliasnaur.com> <elias.naur@gmail.com>  
Elliot Morrison-Reed <elliottmr@gmail.com>  
Ellison Leao <ellisonleao@gmail.com>  
Emerson Lin <linyintor@gmail.com>  
Emil Hessman <emil@hessman.se>  
Emil Mursalimov <mursalimovemeel@gmail.com>  
Emilien Kenler <hello@emilienkenler.com>  
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>  
Emrecan Bati <emrecanbati@gmail.com>  
Eno Compton <enocom@google.com>  
Eoghan Sherry <ejsherry@gmail.com>  
Eric Biggers <ebiggers@google.com>  
Eric Brown <browne@vmware.com>  
Eric Chiang <eric.chiang.m@gmail.com>  
Eric Clark <zerohp@gmail.com>  
Eric Daniels <eric@erdaniels.com>  
Eric Engestrom <eric@engestrom.ch>  
Eric Garrido <ekg@google.com>  
Eric Koleda <ekoleda+devrel@google.com>  
Eric Lagergren <ericscottlagergren@gmail.com>

Eric Milliken <emilliken@gmail.com>  
Eric Pauley <eric@pauley.me>  
Eric Ponce <tricokun@gmail.com>  
Eric Rescorla <ekr@rtfm.com>  
Eric Roshan-Eisner <eric.d.eisner@gmail.com>  
Eric Rutherford <erutherford@gmail.com>  
Eric Rykwalder <e.rykwalder@gmail.com>  
Erick Tryzelaar <etryzelaar@google.com>  
Erik Aigner <aigner.erik@gmail.com>  
Erik Dubbelboer <erik@dubbelboer.com>  
Erik St. Martin <alakriti@gmail.com>  
Erik Staab <estaab@google.com>  
Erik Westrup <erik.westrup@gmail.com>  
Erin Masatsugu <erin.masatsugu@gmail.com>  
Ernest Chiang <ernest\_chiang@htc.com>  
Erwin Oegema <blablaechthema@hotmail.com>  
Esko Luontola <esko.luontola@gmail.com>  
Ethan Burns <eaburns@google.com>  
Ethan Miller <eamiller@us.ibm.com>  
Euan Kemp <euank@euank.com>  
Eugene Formanenko <mo4islona@gmail.com>  
Eugene Kalinin <e.v.kalinin@gmail.com>  
Evan Broder <evan@stripe.com>  
Evan Brown <evanbrown@google.com>  
Evan Digby <evandigby@gmail.com>  
Evan Hicks <evan.hicks2@gmail.com>  
Evan Jones <ej@evanjones.ca>  
Evan Klitzke <evan@eklitzke.org>  
Evan Kroske <evankroske@google.com>  
Evan Martin <evan.martin@gmail.com>  
Evan Phoenix <evan@phx.io>  
Evan Shaw <chickencha@gmail.com>  
Evgeniy Kulikov <tuxuls@gmail.com>  
Evgeniy Polyakov <zbr@ioremap.net>  
Ewan Chou <coocood@gmail.com>  
Ewan Valentine <ewan.valentine89@gmail.com>  
Eyal Posener <posener@gmail.com>  
Fabian Wickborn <fabian@wickborn.net>  
Fabian Zaremba <fabian@youremail.eu>  
Fabrizio Milo <mistobaan@gmail.com>  
Faiyaz Ahmed <ahmedf@vmware.com>  
Fan Hongjian <fan.howard@gmail.com>  
Fangming Fang <fangming.fang@arm.com>  
Fannie Zhang <fannie.zhang@arm.com>  
Fatih Arslan <fatih@arslan.io>  
Fazal Majid <majid@apsalar.com>  
Fazlul Shahriar <fshahriar@gmail.com>  
Federico Bond <federicobond@gmail.com>

Federico Simoncelli <fsimonce@redhat.com>  
Fedor Indutny <fedor@indutny.com>  
Fedor Korotkiy <dartslon@gmail.com>  
Felipe Oliveira <felipeweb.programador@gmail.com>  
Felix Bnemann <Felix.Buenemann@gmail.com>  
Felix Cornelius <9767036+fcornelius@users.noreply.github.com>  
Felix Geisendrfer <haimuiba@gmail.com>  
Felix Kollmann <fk@konsorten.de>  
Ferenc Szabo <frncmx@gmail.com>  
Filip Gruszczyski <gruszczzy@gmail.com>  
Filip Haglund <drathier@users.noreply.github.com>  
Filip Stanis <fstanis@google.com>  
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>  
Firmansyah Adiputra <frm.adiputra@gmail.com>  
Florian Forster <octo@google.com>  
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>  
Florian Weimer <fw@deneb.enyo.de>  
Florin Patan <florinpatan@gmail.com>  
Folke Behrens <folke@google.com>  
Ford Hurley <ford.hurley@gmail.com>  
Francesc Campoy <campoy@golang.org>  
Francesco Renzi <rentziass@gmail.com>  
Francisco Claude <fclaude@recoded.cl>  
Francisco Rojas <francisco.rojas.gallegos@gmail.com>  
Francisco Souza <franciscossouza@gmail.com>  
Frank Schroeder <frank.schroeder@gmail.com>  
Frank Somers <fsomers@arista.com>  
Frederic Guillot <frederic.guillot@gmail.com>  
Frederick Kelly Mayle III <frederickmayle@gmail.com>  
Frederik Ring <frederik.ring@gmail.com>  
Frederik Zipp <fzipp@gmx.de>  
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>  
Fredrik Forsmo <fredrik.forsmo@gmail.com>  
Fredrik Wallgren <fredrik.wallgren@gmail.com>  
Frew Schmidt <github@frew.co>  
Frithjof Schulze <schulze@math.uni-hannover.de> <sfritjhof@gmail.com>  
Frits van Bommel <fvbommel@gmail.com>  
Fujimoto Kyosuke <kyoro.f@gmail.com>  
Fumitoshi Ukai <ukai@google.com>  
G. Hussain Chinoy <ghchinoy@gmail.com>  
Gaal Yahas <gaal@google.com>  
Gabrel Arthr Ptursson <gabriel@system.is>  
Gabriel Aszalos <gabriel.aszalos@gmail.com>  
Gabriel Guzman <gabe.guzman@gmail.com>  
Gabriel Nelle <tehsphinx@web.de>  
Gabriel Nicolas Avellaneda <avellaneda.gabriel@gmail.com>  
Gabriel Rosenhouse <rosenhouse@gmail.com>  
Gabriel Russell <gabriel.russell@gmail.com>



Gareth Paul Jones <gpj@foursquare.com>  
Garret Kelly <gdk@google.com>  
Garrick Evans <garrick@google.com>  
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>  
Gary Elliott <garyelliott@google.com>  
Gaurish Sharma <contact@gaurishsharma.com>  
Gautham Thambidorai <gautham.dorai@gmail.com>  
Gauthier Jolly <gauthier.jolly@gmail.com>  
Gawen Arab <gawen.arab@c.zen.ly>  
Geert-Johan Riemer <gjr19912@gmail.com>  
Genevieve Luyt <genevieve.luyt@gmail.com>  
Gengliang Wang <ltnwgl@gmail.com>  
Geoff Berry <gberry.qdt@qualcommdatacenter.com>  
Geoffroy Lorieux <lorieux.g@gmail.com>  
Geon Kim <geon0250@gmail.com>  
Georg Reinke <guelfey@gmail.com>  
George Gkirtsou <ggirtsou@gmail.com>  
George Hartzell <hartzell@alerce.com>  
George Shammas <george@shamm.as> <georgyo@gmail.com>  
Gerasimos (Makis) Maropoulos <kataras2006@hotmail.com>  
Gerasimos Dimitriadis <gedimitr@gmail.com>  
Gergely Brautigam <skarlso777@gmail.com>  
Gernot Vormayr <gvormayr@gmail.com>  
Gert Cuykens <gert.cuykens@gmail.com>  
Getulio Snchez <valentin2507@gmail.com>  
Ghazni Nattarshah <ghazni.nattarshah@gmail.com>  
Gianguido Sora` <g.sora4@gmail.com>  
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>  
Giles Lean <giles.lean@pobox.com>  
Giovanni Bajo <rasky@develer.com>  
GitHub User @aca (50316549) <acadx0@gmail.com>  
GitHub User @ajnrp (1688456) <ajnrp@users.noreply.github.com>  
GitHub User @ajz01 (4744634) <ajzdenek@gmail.com>  
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>  
GitHub User @andig (184815) <cpuidle@gmx.de>  
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>  
GitHub User @as (8127015) <as.utf8@gmail.com>  
GitHub User @bakape (7851952) <bakape@gmail.com>  
GitHub User @bgadrian (830001) <aditza8@gmail.com>  
GitHub User @bontequero (2674999) <bontequero@gmail.com>  
GitHub User @cch123 (384546) <buaa.cch@gmail.com>  
GitHub User @chainhelen (7046329) <chainhelen@gmail.com>  
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>  
GitHub User @cncal (23520240) <flycalvin@qq.com>  
GitHub User @DQNEO (188741) <dqneo@gmail.com>  
GitHub User @Dreamacro (8615343) <chuainian@gmail.com>  
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>  
GitHub User @erifan (31343225) <eric.fang@arm.com>

GitHub User @esell (9735165) <eujon.sellers@gmail.com>  
GitHub User @fatedier (7346661) <fatedier@gmail.com>  
GitHub User @frennkie (6499251) <mail@rhab.de>  
GitHub User @geedchin (11672310) <geedchin@gmail.com>  
GitHub User @GrigoriyMikhalkin (3637857) <grigoriymikhalkin@gmail.com>  
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>  
GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>  
GitHub User @jinmiaoluo (39730824) <jinmiaoluo@icloud.com>  
GitHub User @jobbrown (6345470) <msshane2008@gmail.com>  
GitHub User @kazysshr (30496953) <kazysshr0301@gmail.com>  
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>  
GitHub User @Kropekk (13366453) <kamilkropiewnicki@gmail.com>  
GitHub User @linguohua (3434367) <lghchinaidea@gmail.com>  
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>  
GitHub User @ly303550688 (11519839) <yang.liu636@gmail.com>  
GitHub User @madiganz (18340029) <zacharymadigan@gmail.com>  
GitHub User @maltalex (10195391) <code@bit48.net>  
GitHub User @Matts966 (28551465) <Matts966@users.noreply.github.com>  
GitHub User @micnncim (21333876) <micnncim@gmail.com>  
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>  
GitHub User @nu50218 (40682920) <nu\_ll@icloud.com>  
GitHub User @OlgaVIPetrova (44112727) <OVPPetrova@gmail.com>  
GitHub User @pityonline (438222) <pityonline@gmail.com>  
GitHub User @po3rin (29445112) <abctail30@gmail.com>  
GitHub User @pokutuna (57545) <popopopokutuna@gmail.com>  
GitHub User @pytimer (17105586) <lixin20101023@gmail.com>  
GitHub User @ramenjuniti (32011829) <ramenjuniti@gmail.com>  
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>  
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>  
GitHub User @skanehira (7888591) <sho19921005@gmail.com>  
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>  
GitHub User @tell-k (26263) <ffk2005@gmail.com>  
GitHub User @tennashi (10219626) <tennashio@gmail.com>  
GitHub User @uhei (2116845) <uhei@users.noreply.github.com>  
GitHub User @uropek (39370426) <uropek@gmail.com>  
GitHub User @utkarsh-extc (53217283) <utkarsh.extc@gmail.com>  
GitHub User @witchard (4994659) <witchard@hotmail.co.uk>  
GitHub User @yah01 (12216890) <kagaminehuan@gmail.com>  
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>  
GitHub User @zikaeroh (48577114) <zikaeroh@gmail.com>  
GitHub User @ZZMarquis (7624583) <zhonglingjian3821@163.com>  
Giulio Iotti <dullgiulio@gmail.com>  
Giulio Micheloni <giulio.micheloni@gmail.com>  
Giuseppe Valente <gvalente@arista.com>  
Gleb Stepanov <glebstepanov1992@gmail.com>  
Glenn Brown <glennb@google.com>  
Glenn Lewis <gmlewis@google.com>  
Gordon Klaus <gordon.klaus@gmail.com>

Gordon Tyler <gordon@doxxx.net>  
Graham King <graham4king@gmail.com>  
Graham Miller <graham.miller@gmail.com>  
Grant Griffiths <ggp493@gmail.com>  
Greg Poirier <greg.istehbest@gmail.com>  
Greg Steuck <gnezdo+github@google.com>  
Greg Thelen <gthelen@google.com>  
Greg Ward <greg@gerg.ca>  
Grgoire Delattre <gregoire.delattre@gmail.com>  
Gregory Man <man.gregory@gmail.com>  
Gregory Petrosyan <gregory.petrosyan@gmail.com>  
Guilherme Caruso <gui.martinscaruso@gmail.com>  
Guilherme Garnier <guilherme.garnier@gmail.com>  
Guilherme Goncalves <guilhermeaugustosg@gmail.com>  
Guilherme Rezende <guilhermebr@gmail.com>  
Guillaume J. Charmes <guillaume@charmes.net>  
Gnther Noack <gnoack@google.com>  
Guobiao Mei <meiguobiao@gmail.com>  
Guoliang Wang <iamwgliang@gmail.com>  
Gustav Paul <gustav.paul@gmail.com>  
Gustav Westling <gustav@westling.xyz>  
Gustavo Franco <gustavorfranco@gmail.com>  
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>  
Gwenael Treguier <gwenn.kahz@gmail.com>  
Gyu-Ho Lee <gyuhox@gmail.com>  
H. brahim Gngr <igungor@gmail.com>  
Hajime Hoshi <hajimehoshi@gmail.com>  
Hallgrimur Gunnarsson <halg@google.com>  
HAMANO Tsukasa <hamano@osstech.co.jp>  
Han-Wen Nienhuys <hanwen@google.com>  
Hang Qian <hangqian90@gmail.com>  
Hanjun Kim <hallazzang@gmail.com>  
Haosdent Huang <haosdent@gmail.com>  
Harald Nordgren <haraldnordgren@gmail.com>  
Hari haran <hariharan.uno@gmail.com>  
Hariharan Srinath <srinathh@gmail.com>  
Harley Laue <losinggeneration@gmail.com>  
Harry Moreno <morenoh149@gmail.com>  
Harshavardhana <hrshvardhana@gmail.com>  
Hasan Ozgan <hasan@ozgan.net>  
Hasit Bhatt <hasit.p.bhatt@gmail.com>  
Hauke Lffler <hloeffler@users.noreply.github.com>  
Hvard Haugen <havard.haugen@gmail.com>  
He Liu <liulonnie@gmail.com>  
Hector Chu <hectorchu@gmail.com>  
Hector Martin Cantero <hector@marcansoft.com>  
Henning Schmiedehausen <henning@schmiedehausen.org>  
Henrik Edwards <henrik.edwards@gmail.com>

Henrik Hodne <henrik@hodne.io>  
Henry Adi Sumarto <henry.adisumarto@gmail.com>  
Henry Bubert <google@mindeco.de>  
Henry Chang <mr.changyuheng@gmail.com>  
Henry Clifford <h.a.clifford@gmail.com>  
Henry Wong <liushuai.wang@elastic.co>  
Herbert Georg Fischer <herbert.fischer@gmail.com>  
Herbie Ong <herbie@google.com>  
Heschi Kreinick <heschi@google.com>  
Hidetatsu Yaginuma <ygnmhdt@gmail.com>  
Hilko Bengen <bengen@hilluzination.de>  
Hiroaki Nakamura <hnakamur@gmail.com>  
Hiromichi Ema <ema.hiro@gmail.com>  
Hironao OTSUBO <motemen@gmail.com>  
Hiroshi Ioka <hirochachacha@gmail.com>  
Hitoshi Mitake <mitake.hitoshi@gmail.com>  
Holden Huang <ttyh061@gmail.com>  
Hong Ruiqi <hongruiqi@gmail.com>  
Hongfei Tan <feilengcui008@gmail.com>  
Horacio Duran <horacio.duran@gmail.com>  
Horst Rutter <hhrutter@gmail.com>  
Hossein Sheikh Attar <hattar@google.com>  
Howard Zhang <howard.zhang@arm.com>  
Hsin Tsao <tsao@google.com>  
Hsin-Ho Yeh <yhh92u@gmail.com>  
Hu Keping <hukeping@huawei.com>  
Huan Du <i@huandu.me>  
Hugues Bruant <hugues.bruant@gmail.com>  
Huy Le <huy.dinh.le.89@gmail.com>  
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>  
Hyoyoung Chang <hyoyoung@gmail.com>  
Ian Cottrell <iancottrell@google.com>  
Ian Davis <nospam@iandavis.com>  
Ian Gudger <ian@loosescre.ws>  
Ian Haken <ihaken@netflix.com>  
Ian Kent <iankent85@gmail.com>  
Ian Lance Taylor <iant@golang.org>  
Ian Leue <ian@appboy.com>  
Ian Zapolsky <ianzapolsky@gmail.com>  
Ibrahim AshShohail <ibra.sho@gmail.com>  
Icarus Sparry <golang@icarus.freeuk.com>  
Iccha Sethi <icchasethi@gmail.com>  
Idora Shinatose <idora.shinatose@gmail.com>  
Ignacio Hagopian <jsign.uy@gmail.com>  
Igor Bernstein <igorbernstein@google.com>  
Igor Dolzhikov <bluesriverz@gmail.com>  
Igor Vashyst <ivashyst@gmail.com>  
Igor Zhilianin <igor.zhilianin@gmail.com>

Ilya Yalovyy <yalovoy@gmail.com>  
Ilya Sinelnikov <sidhmangh@gmail.com>  
Ilya Tocar <ilya.tocar@intel.com>  
INADA Naoki <songofacandy@gmail.com>  
Inanc Gumus <m@inanc.io>  
Ingo Gottwald <in.gottwald@gmail.com>  
Ingo Krabbe <ikrabbe.ask@gmail.com>  
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>  
Ioannis Georgoulas <geototti21@hotmail.com>  
Irbe Krumina <irbekrm@gmail.com>  
Irfan Sharif <irfanmahmoudsharif@gmail.com>  
Irieda Noboru <irieda@gmail.com>  
Isaac Ardis <isaac.ardis@gmail.com>  
Isaac Wagner <ibw@isaacwagner.me>  
Isfan Azhabil <isfanazhabil@gmail.com>  
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>  
Issac Trotts <issactrotts@google.com>  
Ivan Babrou <ivan@cloudflare.com>  
Ivan Bertona <ivan.bertona@gmail.com>  
Ivan Krasin <krasin@golang.org>  
Ivan Kutuzov <arbrix@gmail.com>  
Ivan Markin <sw@nogoegst.net>  
Ivan Moscoso <moscoso@gmail.com>  
Ivan Osadchii <ivan.osadchii@gmail.com>  
Ivan Sharavuev <shpiwan@gmail.com>  
Ivan Trubach <mr.trubach@icloud.com>  
Ivan Ukhov <ivan.ukhov@gmail.com>  
Ivy Evans <ivy@ivyevans.net>  
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>  
Jaap Aarts <jjaap.aarts1@gmail.com>  
Jack Britton <jackxbritton@gmail.com>  
Jack Lindamood <jlindamo@justin.tv>  
Jacob Baskin <jbaskin@google.com>  
Jacob Blain Christen <dweomer5@gmail.com>  
Jacob H. Haven <jacob@cloudflare.com>  
Jacob Hoffman-Andrews <github@hoffman-andrews.com>  
Jacob Walker <jacobwalker0814@gmail.com>  
Jae Kwon <jae@tendermint.com>  
Jake B <doogie1012@gmail.com>  
Jakob Borg <jakob@nym.se>  
Jakob Weisblat <jakobw@mit.edu>  
Jakub ajka <jcajka@redhat.com>  
Jakub Kaczmarzyk <jakubk@mit.edu>  
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>  
Jamal Carvalho <jamal.a.carvalho@gmail.com>  
James Aguilar <jaguilar@google.com>  
James Bardin <j.bardin@gmail.com>  
James Chacon <jchacon@google.com>

James Clarke <jrtc27@jrtc27.com>  
James Cowgill <James.Cowgill@imgtec.com>  
James Craig Burley <james-github@burleyarch.com>  
James David Chalfant <james.chalfant@gmail.com>  
James Eady <jmeady@google.com>  
James Fysh <james.fysh@gmail.com>  
James Gray <james@james4k.com>  
James Hartig <fastest963@gmail.com>  
James Lawrence <jljatone@gmail.com>  
James Meneghello <rawrz0r@gmail.com>  
James Myers <jfmyers9@gmail.com>  
James Neve <jamesoneve@gmail.com>  
James Nugent <james@jen20.com>  
James P. Cooper <jamespcooper@gmail.com>  
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>  
James Schofield <james@shooboxapp.com>  
James Smith <jrs1995@icloud.com>  
James Sweet <james.sweet88@googlemail.com>  
James Toy <nil@opensesame.st>  
James Treanor <jtreanor3@gmail.com>  
James Tucker <raggi@google.com>  
James Whitehead <jnwhiteh@gmail.com>  
Jamie Beverly <jamie.r.beverly@gmail.com>  
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>  
Jamie Kerr <jkerr113@googlemail.com>  
Jamie Liu <jameliu@google.com>  
Jamie Stackhouse <contin673@gmail.com>  
Jamie Turner <jamwt@dropbox.com>  
Jamie Wilkinson <jaq@spacepants.org>  
Jamil Djadala <djadala@gmail.com>  
Jan Berktold <jan@berktold.co>  
Jan H. Hosang <jan.hosang@gmail.com>  
Jan Kratochvil <jan.kratochvil@redhat.com>  
Jan Lehnardt <jan@apache.org>  
Jan Mercl <0xjnm@gmail.com> <befelemepeseveze@gmail.com>  
Jan Newmarch <jan.newmarch@gmail.com>  
Jan Pilzer <jan.pilzer@gmx.de>  
Jan Steinke <jan.steinke@gmail.com>  
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>  
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>  
Jannis Andrija Schnitzer <jannis@schnitzer.im>  
Jared Allard <jaredallard@users.noreply.github.com>  
Jared Culp <jculp14@gmail.com>  
Jaroslav Poepko <jp@webmaster.ms>  
Jason A. Donenfeld <Jason@zx2c4.com>  
Jason Baker <jason-baker@users.noreply.github.com>  
Jason Barnett <jason.w.barnett@gmail.com>  
Jason Buberel <jbuberel@google.com>

Jason Chu <jasonchujc@gmail.com>  
Jason Del Ponte <delpontej@gmail.com>  
Jason Hall <jasonhall@google.com>  
Jason Keene <jasonkeene@gmail.com>  
Jason LeBrun <jblebrun@gmail.com>  
Jason Smale <jsmale@zendesk.com>  
Jason Travis <infomaniac7@gmail.com>  
Jason Wangsadinata <jwangsadinata@gmail.com>  
Javier Kohen <jkohen@google.com>  
Javier Revillas <jrevillas@massivedynamic.io>  
Javier Segura <javism@gmail.com>  
Jay Conrod <jayconrod@google.com>  
Jay Taylor <outtatime@gmail.com>  
Jay Weisskopf <jay@jayschwa.net>  
Jean de Klerk <deklerk@google.com>  
Jean-Andr Santoni <jean.andre.santoni@gmail.com>  
Jean-Franois Bustarret <jf@bustarret.com>  
Jean-Francois Cantin <jfcantin@gmail.com>  
Jean-Marc Eurin <jmeurin@google.com>  
Jean-Nicolas Moal <jn.moal@gmail.com>  
Jed Denlea <jed@fastly.com>  
Jdrzej Szczepaniak <jbszczepaniak@gmail.com>  
Jeet Parekh <jeetparekh96@gmail.com>  
Jeevanandam M <jeeva@myjeeva.com>  
Jeff (Zhefu) Jiang <jeffjiang@google.com>  
Jeff Craig <jeffcraig@google.com>  
Jeff Dupont <jeff.dupont@gmail.com>  
Jeff Hodges <jeff@somethingsimilar.com>  
Jeff Johnson <jrjohnson@google.com>  
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>  
Jeff Sickel <jas@corpus-callosum.com>  
Jeff Wendling <jeff@spacemonkey.com>  
Jeffrey H <jeffreyh192@gmail.com>  
Jelte Fennema <github-tech@jeltef.nl>  
Jens Frederich <jfrederich@gmail.com>  
Jeremiah Harmsen <jeremiah@google.com>  
Jeremy Banks <\_@jeremy.ca>  
Jeremy Canady <jcanady@gmail.com>  
Jeremy Faller <jeremy@golang.org>  
Jeremy Jackins <jeremyjackins@gmail.com>  
Jeremy Jay <jeremy@pbnjay.com>  
Jeremy Schlatter <jeremy.schlatter@gmail.com>  
Jeroen Bobbeldijk <jerbob92@gmail.com>  
Jeroen Simonetti <jeroen@simonetti.nl>  
Jerrin Shaji George <jerrinsg@gmail.com>  
Jess Frazelle <me@jessfraz.com>  
Jesse Szwedko <jesse.szwedko@gmail.com>  
Jess Espino <jespinog@gmail.com>

Jia Zhan <jzhan@uber.com>  
Jiacai Liu <jiacai2050@gmail.com>  
Jianing Yu <jnyu@google.com>  
Jianqiao Li <jianqiaoli@google.com>  
Jie Ma <jienius@outlook.com>  
Jihyun Yu <yjh0502@gmail.com>  
Jim Cote <jfcote87@gmail.com>  
Jim Kingdon <jim@bolt.me>  
Jim McGrath <jimmc2@gmail.com>  
Jim Minter <jminter@redhat.com>  
Jimmy Frasche <soapboxcicero@gmail.com>  
Jimmy Zelinskie <jimmyzelinskie@gmail.com>  
Jin-wook Jeong <jeweljar@hanmail.net>  
Jingcheng Zhang <diogin@gmail.com>  
Jingguo Yao <yaojingguo@gmail.com>  
Jingnan Si <jingnan.si@gmail.com>  
Jinkun Zhang <franksnolf@gmail.com>  
Jiong Du <londdevil@gmail.com>  
Jirka Dank <dnk@mail.muni.cz>  
Jiulong Wang <jiulongw@gmail.com>  
Joakim Sernbrant <serbaut@gmail.com>  
Joe Bowbeer <joe.bowbeer@gmail.com>  
Joe Cortopassi <joe@joecortopassi.com>  
Joe Farrell <joe2farrell@gmail.com>  
Joe Harrison <joehazzers@gmail.com>  
Joe Henke <joed.henke@gmail.com>  
Joe Kyo <xunianzu@gmail.com>  
Joe Poirier <jdpoirier@gmail.com>  
Joe Richey <joerichey@google.com>  
Joe Shaw <joe@joeshaw.org>  
Joe Sylve <joe.sylve@gmail.com>  
Joe Tsai <joetsai@digital-static.net>  
Joel Sing <joel@sing.id.au> <jsing@google.com>  
Jol Stemmer <jstemmer@google.com>  
Joel Stemmer <stemmertech@gmail.com>  
Joey Geiger <jgeiger@users.noreply.github.com>  
Johan Brandhorst <johan.brandhorst@gmail.com>  
Johan Euphrosine <proppy@google.com>  
Johan Jansson <johan.jansson@iki.fi>  
Johan Sageryd <j@1616.se>  
John Asmuth <jasmuth@gmail.com>  
John Beisley <huin@google.com>  
John C Barstow <jbowtie@amathaine.com>  
John DeNero <denero@google.com>  
John Dethridge <jcd@golang.org>  
John Gibb <johngibb@gmail.com>  
John Gilik <john@jgilik.com>  
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>



John Howard Palevich <jack.palevich@gmail.com>  
John Jeffery <jjeffery@sp.com.au>  
John Jenkins <twodopeshaggy@gmail.com>  
John Leidegren <john.leidegren@gmail.com>  
John McCabe <john@johnmccabe.net>  
John Moore <johnkenneth.moore@gmail.com>  
John Newlin <jnewlin@google.com>  
John Papandriopoulos <jpap.code@gmail.com>  
John Potocny <johnp@vividcortex.com>  
John R. Lenton <jlenton@gmail.com>  
John Schnake <schnake.john@gmail.com>  
John Shahid <jvshahid@gmail.com>  
John Tuley <john@tuley.org>  
John Weldon <johnweldon4@gmail.com>  
Johnny Luo <johnnyluo1980@gmail.com>  
Jon Chen <jchen@justin.tv>  
Jon Johnson <jonjohnson@google.com>  
Jonas Bernoulli <jonas@bernoul.li>  
Jonathan Allie <jonallie@google.com>  
Jonathan Amsterdam <jba@google.com>  
Jonathan Boule <jonathanboule@gmail.com>  
Jonathan Chen <dijonkitchen@users.noreply.github.com>  
Jonathan Feinberg <feinberg@google.com>  
Jonathan Gold <jgold.bg@gmail.com>  
Jonathan Hseu <jhseu@google.com>  
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>  
Jonathan Nieder <jrn@google.com>  
Jonathan Pentecost <pentecostjonathan@gmail.com>  
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>  
Jonathan Rudenberg <jonathan@titanous.com>  
Jonathan Stacks <jonstacks13@gmail.com>  
Jonathan Wills <runningwild@gmail.com>  
Jonathon Lacher <jonathon.lacher@gmail.com>  
Jongmin Kim <atomaths@gmail.com>  
Joonas Kuorilehto <joneskoo@derbian.fi>  
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>  
Jordan Christiansen <xordspar0@gmail.com>  
Jordan Krage <jmank88@gmail.com>  
Jordan Lewis <jordanthelewis@gmail.com>  
Jordan Liggitt <liggitt@google.com>  
Jordan Rhee <jordanrh@microsoft.com>  
Jordi Martin <jordimartin@gmail.com>  
Jorge Araya <jorgejavieran@yahoo.com.mx>  
Jorge L. Fatta <jorge.fatta@auth0.com>  
Jos Visser <josv@google.com>  
Josa Gesell <josa@gesell.me>  
Jose Luis Vzquez Gonzlez <josvazg@gmail.com>  
Joseph Bonneau <jcb@google.com>

Joseph Holsten <joseph@josephholsten.com>  
Josh Baum <joshbaum@google.com>  
Josh Bleecher Snyder <josharian@gmail.com>  
Josh Chorlton <jchorlton@gmail.com>  
Josh Deprez <josh.deprez@gmail.com>  
Josh Goebel <dreamer3@gmail.com>  
Josh Hoak <jhoak@google.com>  
Josh Holland <jrh@joshh.co.uk>  
Josh Roppo <joshroppo@gmail.com>  
Josh Varga <josh.varga@gmail.com>  
Joshua Bezaleel Abednego <joshua.bezaleel@gmail.com>  
Joshua Boelter <joshua.boelter@intel.com>  
Joshua Chase <jcjosuachase@gmail.com>  
Joshua Crowgey <jcrowgey@uw.edu>  
Joshua M. Clulow <josh.clulow@joyent.com>  
Joshua Rubin <joshua@rubixconsulting.com>  
Josselin Costanzi <josselin@costanzi.fr>  
Jostein Stuhaug <js@solidsystem.no>  
JP Sugarbroad <jpsugar@google.com>  
JT Olds <jtolds@xnet5.com>  
JT Olio <hello@jtolio.com>  
Juan Carlos <juanjcsr@gmail.com>  
Juan Pablo Civile <elementohb@gmail.com>  
Jude Pereira <judebpereira@gmail.com>  
Jukka-Pekka Kekkonen <karatepekka@gmail.com>  
Julia Hansbrough <flowerhack@google.com>  
Julian Kornberger <jk+github@digineo.de>  
Julian Pastarmov <pastarmovj@google.com>  
Julian Phillips <julian@quantumfyre.co.uk>  
Julian Tibble <julian.tibble@gmail.com>  
Julie Qiu <julie@golang.org>  
Julien Kauffmann <julien.kauffmann@freelan.org>  
Julien Salleyron <julien.salleyron@gmail.com>  
Julien Schmidt <google@julienschmidt.com>  
Julio Montes <julio.montes@intel.com>  
Jun Zhang <jim.zoumo@gmail.com>  
Junda Liu <junda@celer.network>  
Junggho Ahn <jhahn@google.com>  
Junya Hayashi <ledmonster@gmail.com>  
Juraj Sukop <sukop@users.noreply.github.com>  
Jure Ham <jure.ham@zemanta.com>  
Justin Gracenin <jgracenin@gmail.com>  
Justin Li <git@justinli.net>  
Justin Nu <nuss.justin@gmail.com>  
Justyn Temme <justyntemme@gmail.com>  
Kai Backman <kaib@golang.org>  
Kai Dong <dokia2357@gmail.com>  
Kai Trukenmller <ktye78@gmail.com>

Kale Blankenship <kale@lemnisis.com>  
Kaleb Elwert <kelwert@atlassian.com>  
Kalman Bekesi <kalmanb@google.com>  
Kamal Aboul-Hosn <aboulhosn@google.com>  
Kamil Chmielewski <kamil.chm@gmail.com>  
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>  
Kamil Rytarowski <krytarowski@users.noreply.github.com>  
Kang Hu <hukangustc@gmail.com>  
Kanta Ebihara <kantaebihara@gmail.com>  
Karan Dhiman <karandhi@ca.ibm.com>  
Karel Pazdera <pazderak@gmail.com>  
Karoly Negyesi <chx1975@gmail.com>  
Karsten Khler <karsten.koehler95@gmail.com>  
Karthik Nayak <karthik.188@gmail.com>  
Kashav Madan <kshvmdn@gmail.com>  
Kate Manson <kate.manson@izettle.com>  
Katharine Berry <ktbry@google.com>  
Katie Hockman <katie@golang.org>  
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>  
Katrina Owen <katrina.owen@gmail.com>  
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>  
Kay Zhu <kayzhu@google.com>  
Kazuhiro Sera <seratch@gmail.com>  
KB Sriram <kbsriram@google.com>  
Keegan Carruthers-Smith <keegan.csmith@gmail.com>  
Kei Son <hey.calmdown@gmail.com>  
Keiji Yoshida <keijiyoshida.mail@gmail.com>  
Keisuke Kishimoto <keisuke.kishimoto@gmail.com>  
Keith Ball <inflatablewoman@gmail.com>  
Keith Randall <khr@golang.org>  
Keith Rarick <kr@xph.us>  
Kelly Heller <pestophagous@gmail.com>  
Kelsey Hightower <kelsey.hightower@gmail.com>  
Kelvin Foo Chuan Lyi <vmirage@gmail.com>  
Ken Friedenbach <kenliz@cruzio.com>  
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>  
Ken Sedgwick <ken@bonsai.com>  
Ken Thompson <ken@golang.org>  
Kenichi Tsunokawa <kenichi.tsunokawa@gmail.com>  
Kenji Kaneda <kenji.kaneda@gmail.com>  
Kenji Yano <kenji.yano@gmail.com>  
Kenneth Shaw <kenshaw@gmail.com>  
Kenny Grant <kennygrant@gmail.com>  
Kenta Mori <zoncoen@gmail.com>  
Kerollos Magdy <kerolloz@yahoo.com>  
Ketan Parmar <ketanbparmar@gmail.com>  
Kevan Swanberg <kevswanberg@gmail.com>  
Kevin Ballard <kevin@sb.org>

Kevin Burke <kev@inburke.com>  
Kvin Dunglas <dunglas@gmail.com>  
Kevin Gillette <extemporalgenome@gmail.com>  
Kevin Kirsche <kev.kirsche@gmail.com>  
Kevin Klues <klueska@gmail.com> <klueska@google.com>  
Kevin Malachowski <chowski@google.com>  
Kevin Ruffin <kruffin@gmail.com>  
Kevin Vu <kevin.m.vu@gmail.com>  
Kevin Zita <bleedgreenandgold@gmail.com>  
Keyan Pishdadian <kpishdadian@gmail.com>  
Kezhu Wang <kezhuw@gmail.com>  
Khosrow Moossavi <khos2ow@gmail.com>  
Kieran Colford <kieran@kcolford.com>  
Kim Shrier <kshrier@racktopsystems.com>  
Kim Yongbin <kybinz@gmail.com>  
Kir Kolyshkin <kolyshkin@gmail.com>  
Kirill Korotaev <kirillx@gmail.com>  
Kirill Motkov <Motkov.Kirill@gmail.com>  
Kirill Smelkov <kirr@nexedi.com>  
Kirill Tatchihin <kirabsuir@gmail.com>  
Kirk Han <kirk91.han@gmail.com>  
Kirklin McDonald <kirklin.mcdonald@gmail.com>  
Klaus Post <klauspost@gmail.com>  
Kodie Goodwin <kodiegoodwin@gmail.com>  
Koichi Shiraishi <zchee.io@gmail.com>  
Koki Ide <niconegoto@yahoo.co.jp>  
Koki Tomoshige <tomocy.dev@gmail.com>  
Komu Wairagu <komuw05@gmail.com>  
Konstantin <konstantin8105@gmail.com>  
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>  
Koya IWAMURA <kiwamura0314@gmail.com>  
Kris Kwiatkowski <kris@cloudflare.com>  
Kris Nova <kris@nivenly.com>  
Kris Rousey <krousey@google.com>  
Kristopher Watts <traetox@gmail.com>  
Kshitij Saraogi <kshitijgaraogi@gmail.com>  
Kun Li <likunarmstrong@gmail.com>  
Kunpei Sakai <namusyaka@gmail.com>  
Kuntal Majumder <hellozee@disroot.org>  
Kush Patel <kush.patel@hootsuite.com>  
Kyle Consalus <consalus@gmail.com>  
Kyle Isom <kyle@gokyle.net>  
Kyle Jones <kyle@kyledj.com>  
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>  
Kyle Nusbaum <kyle@datadog.com>  
Kyle Shannon <kyle@pobox.com>  
Kyle Spiers <eiais@google.com>  
Kyle Wood <kyle@kylewood.cc>

Kyohei Kadota <lufia@lufia.org>  
Kyrylo Silin <silin@kyrylo.org>  
L Campbell <unpantsu@gmail.com>  
Lai Jiangshan <eag0628@gmail.com>  
Lajos Papp <lalyos@yahoo.com>  
Lakshay Garg <lakshay.garg.1996@gmail.com>  
Lann Martin <lanm@google.com>  
Lanre Adelowo <yo@lanre.wtf>  
Larry Clapp <larry@theclapp.org>  
Larry Hosken <lahosken@golang.org>  
Lars Jeppesen <jeppesen.lars@gmail.com>  
Lars Lehtonen <lars.lehtonen@gmail.com>  
Lars Wiegman <lars@namsral.com>  
Larz Conwell <larzconwell@gmail.com>  
Laurent Voisin <lpvoisin@gmail.com>  
Laurie Clark-Michalek <laurie@qubit.com>  
LE Manh Cuong <cuong.manhle.vn@gmail.com>  
Lee Hinman <hinman@gmail.com>  
Lee Packham <lpackham@gmail.com>  
Lehner Florian <dev@der-flo.net>  
Leigh McCulloch <leighmcc@gmail.com>  
Leo Antunes <leo@costela.net>  
Leo Rudberg <ljr@google.com>  
Leon Klingele <git@leonklingele.de>  
Leonardo Comelli <leonardo.comelli@gmail.com>  
Leonel Quinteros <leonel.quinteros@gmail.com>  
Lev Shamardin <shamardin@gmail.com>  
Lewin Bormann <lewin.bormann@gmail.com>  
Liam Haworth <liam@haworth.id.au>  
Lily Chung <lilithkchung@gmail.com>  
Lion Yang <lion@aosc.xyz>  
Liz Rice <liz@lizrice.com>  
Lloyd Dewolf <foolswisdom@gmail.com>  
Lorenz Bauer <lmb@cloudflare.com>  
Lorenz Brun <lorenz@brun.one>  
Lorenz Nickel <mail@lorenznickel.de>  
Lorenzo Masini <rugginoso@develer.com>  
Lorenzo Stoakes <lstoakes@gmail.com>  
Louis Kruger <louisk@google.com>  
Luan Santos <cfcluan@gmail.com>  
Lubomir I. Ivanov <neolit123@gmail.com>  
Luca Bruno <luca.bruno@coreos.com>  
Luca Greco <luca.greco@alcacoop.it>  
Lucas Bremgartner <lucas.bremgartner@gmail.com>  
Lucas Clemente <lclemente@google.com>  
Lucien Stuker <lucien.stuker@gmail.com>  
Lucio De Re <lucio.dere@gmail.com>  
Ludi Rehak <ludi317@gmail.com>

Luigi Riefolo <luigi.riefolo@gmail.com>  
Luit van Drongelen <luitvd@gmail.com>  
Luka Zakrajek <tr00.g33k@gmail.com>  
Luka Zitnik <luka.zitnik@gmail.com>  
Lukasz Milewski <lmmilewski@gmail.com>  
Luke Champine <luke.champine@gmail.com>  
Luke Curley <qpingu@gmail.com>  
Luke Granger-Brown <git@lukegb.com>  
Luke Young <bored-engineer@users.noreply.github.com>  
Luna Duclos <luna.duclos@palmstonegames.com>  
Luuk van Dijk <lvd@golang.org> <lvd@google.com>  
Lyle Franklin <lylejfranklin@gmail.com>  
Lynn Boger <laboger@linux.vnet.ibm.com>  
Ma Peiqi <mapeiqi2017@gmail.com>  
Maarten Bezemer <maarten.bezemer@gmail.com>  
Maciej Dbski <maciejd@google.com>  
Madhu Rajanna <madhupr007@gmail.com>  
Magnus Hiie <magnus.hiie@gmail.com>  
Maicon Costa <maiconscosta@gmail.com>  
Mak Kolybabi <mak@kolybabi.com>  
Maksym Trykur <maksym.trykur@gmail.com>  
Mal Curtis <mal@mal.co.nz>  
Manfred Touron <m@42.am>  
Manigandan Dharmalingam <manigandan.jeff@gmail.com>  
Manish Goregaokar <manishsmail@gmail.com>  
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>  
Mansour Rahimi <rahimi.mnr@gmail.com>  
Manu Garg <manugarg@google.com>  
Manu S Ajith <neo@codingarena.in>  
Manuel Mendez <mmendez534@gmail.com>  
Marat Khabibullin <marat.khabibullin@jetbrains.com>  
Marc Sanmiquel <marcsanmiquel@gmail.com>  
Marc Weistroff <marc@weistroff.net>  
Marc-Antoine Ruel <maruel@chromium.org>  
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>  
Marcel van Lohuizen <mpvl@golang.org>  
Marcelo Cantos <marcelo.cantos@gmail.com>  
Marcelo E. Magallon <marcelo.magallon@gmail.com>  
Marco Hennings <marco.hennings@freiheit.com>  
Marcus Weiner <marcus.weiner@gmail.com>  
Marcus Willock <crazcalm@gmail.com>  
Marga Manterola <marga@google.com>  
Mariano Cano <mariano@smallstep.com>  
Marin Bai <marin.basic02@gmail.com>  
Mario Arranz <marioarranzr@gmail.com>  
Marius A. Eriksen <marius@grailbio.com>  
Marius Nuennerich <mnu@google.com>  
Mark Adams <mark@markadams.me>

Mark Bucciarelli <mkbucc@gmail.com>  
Mark Glines <mark@glines.org>  
Mark Harrison <marhar@google.com>  
Mark Percival <m@mdp.im>  
Mark Pulford <mark@kyne.com.au>  
Mark Rushakoff <mark.rushakoff@gmail.com>  
Mark Ryan <mark.d.ryan@intel.com>  
Mark Severson <miquella@gmail.com>  
Mark Theunissen <mark.theunissen@gmail.com>  
Mark Villacampa <m@markvillacampa.com>  
Mark Wolfe <mark@wolfe.id.au>  
Mark Zavislak <zavislak@google.com>  
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>  
Marko Kevac <marko@kevac.org>  
Marko Kungla <marko.kungla@gmail.com>  
Marko Mikulicic <mkm@google.com>  
Marko Mudrinic <mudrinic.mare@gmail.com>  
Marko Tiikkaja <marko@joh.to>  
Markus Duft <markus.duft@salomon.at>  
Markus Sonderegger <marraison@gmail.com>  
Markus Zimmermann <zimmski@gmail.com>  
Marten Seemann <martenseemann@gmail.com>  
Martin Asquino <martin.asquino@gmail.com>  
Martin Bertschler <mbertschler@gmail.com>  
Martin Garton <garton@gmail.com>  
Martin Habbecke <marhab@google.com>  
Martin Hamrle <martin.hamrle@gmail.com>  
Martin Hoefling <martin.hoefling@gmx.de>  
Martin Kreichgauer <martinkr@google.com>  
Martin Kunc <martinkunc@users.noreply.github.com>  
Martin Lindhe <martin.j.lindhe@gmail.com>  
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>  
Martin Neubauer <m.ne@gmx.net>  
Martin Olsen <github.com@martinolsen.net>  
Martin Olsson <martin@minimum.se>  
Martin Probst <martin@probst.io>  
Martin Sucha <anty.sk+git@gmail.com>  
Martin Tournoij <martin@arp242.net>  
Martins Sipenko <martins.sipenko@gmail.com>  
Martynas Budrinas <mabu@google.com>  
Marvin Stenger <marvin.stenger94@gmail.com>  
Marwan Sulaiman <marwan.sulaiman@work.co>  
Maryan Hratson <gmarik@gmail.com>  
Masahiro Furudate <masahiro.furudate@gmail.com>  
Masahiro Wakame <vvakame@gmail.com>  
Masaki Yoshida <yoshida.masaki@gmail.com>  
Masaya Watanabe <sfbgwm30@gmail.com>  
Mat Byczkowski <mbyczkowski@gmail.com>

Mat Ryer <thatmatryer@gmail.com>  
Mt Gulys <mgulyas86@gmail.com>  
Matej Bao <matejbaco@gmail.com>  
Mateus Amin <mateus.amin@gmail.com>  
Mateusz Czapliski <czapkofan@gmail.com>  
Mathias Beke <git@denbeke.be>  
Mathias Hall-Andersen <mathias@hall-andersen.dk>  
Mathias Leppich <mleppich@muhqu.de>  
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>  
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>  
Matt Aimonetti <mattaimonetti@gmail.com>  
Matt Blair <me@matthewblair.net>  
Matt Bostock <matt@mattbostock.com>  
Matt Brown <mdbrown@google.com>  
Matt Dee <mdee@hioscar.com>  
Matt Drollette <matt@drollette.com>  
Matt Harden <matt.harden@gmail.com>  
Matt Jibson <matt.jibson@gmail.com>  
Matt Joiner <anacrolix@gmail.com>  
Matt Jones <mrjones@google.com>  
Matt Juran <thepciet@gmail.com>  
Matt Layher <mdllyher@gmail.com>  
Matt Reiferson <mreiferson@gmail.com>  
Matt Robenolt <matt@ydekproductions.com>  
Matt Strong <mstrong1341@gmail.com>  
Matt T. Proud <matt.proud@gmail.com>  
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>  
Matthew Brennan <matty.brennan@gmail.com>  
Matthew Broberg <matthewbbroberg@gmail.com>  
Matthew Cottingham <mattcottingham@gmail.com>  
Matthew Dempsky <mdempsky@google.com>  
Matthew Denton <mdenton@skyportsystems.com>  
Matthew Holt <Matthew.Holt+git@gmail.com>  
Matthew Horsnell <matthew.horsnell@gmail.com>  
Matthew Waters <mwwaters@gmail.com>  
Matthieu Hauglustaine <matt.hauglustaine@gmail.com>  
Matthieu Olivier <olivier.matthieu@gmail.com>  
Matthijs Kooijman <matthijs@stdin.nl>  
Max Riveiro <kavu13@gmail.com>  
Max Schmitt <max@schmitt.mx>  
Max Semenik <maxsem.wiki@gmail.com>  
Max Ushakov <ushmax@gmail.com>  
Maxim Eryomenko <moeryomenko@gmail.com>  
Maxim Khitrov <max@mxcrypt.com>  
Maxim Pimenov <mpimenov@google.com>  
Maxim Pugachev <pugachev.mm@gmail.com>  
Maxim Ushakov <ushakov@google.com>  
Maxime de Roucy <maxime.deroucy@gmail.com>



Mximo Cuadros Ortiz <mcuadros@gmail.com>  
Maxwell Krohn <themax@gmail.com>  
Maya Rashish <maya@NetBSD.org>  
Mayank Kumar <krmayankk@gmail.com>  
Meir Fischer <meirfischer@gmail.com>  
Meng Zhuo <mengzhuo1203@gmail.com> <mzh@golangcn.org>  
Mhd Sulhan <m.shulhan@gmail.com>  
Micah Stetson <micah.stetson@gmail.com>  
Michael Anthony Knyszek <mknyszek@google.com>  
Michael Brandenburg <mbrandenburg@bolste.com>  
Michael Chaten <mchaten@gmail.com>  
Michael Cook <code@mdcook.net>  
Michael Darakananda <pongad@google.com>  
Michael Dorner <mail@michaeldorf.de>  
Michael Edwards <medwards@walledcity.ca>  
Michael Elkins <michael.elkins@gmail.com>  
Michael Ellis <micellis@justin.tv>  
Michael Fraenkel <michael.fraenkel@gmail.com>  
Michael Fromberger <michael.j.fromberger@gmail.com>  
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>  
Michael Henderson <mdhender@users.noreply.github.com>  
Michael Hendricks <michael@ndrix.org>  
Michael Hoisie <hoisie@gmail.com>  
Michael Hudson-Doyle <michael.hudson@linaro.org>  
Michael Kasch <michael.kasch@gmail.com>  
Michael Kufl <golang@c.michael-kaeufl.de>  
Michael Kelly <mjk@google.com>  
Michael Lewis <mikelikespie@gmail.com>  
Michael MacInnis <Michael.P.MacInnis@gmail.com>  
Michael Marineau <michael.marineau@coreos.com>  
Michael Matloob <matloob@google.com>  
Michael McConville <momconville@gmail.com>  
Michael McGreevy <mcgreevy@golang.org>  
Michael McLoughlin <mmcloughlin@gmail.com>  
Michael Munday <mike.munday@ibm.com>  
Michael Pearson <mipearson@gmail.com>  
Michael Piatek <piatek@google.com>  
Michael Pratt <mpratt@google.com>  
Michael Schaller <michael@5challer.de>  
Michael Schurter <michael.schurter@gmail.com>  
Michael Shields <mshields@google.com>  
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>  
Michael Steinert <mike.steinert@gmail.com>  
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>  
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>  
Michael Traver <mtraver@google.com>  
Michael Vetter <g.bluehut@gmail.com>  
Michael Vogt <mvo@ubuntu.com>

Michal Bohuslvek <mbohuslvek@gmail.com>  
Michal Cierniak <cierniak@google.com>  
Micha Derkacz <ziutek@inet.pl>  
Michal Franc <lam.michal.franc@gmail.com>  
Micha owicki <mlowicki@gmail.com>  
Michal Pristas <michal.pristas@gmail.com>  
Michal Rostecki <mrostecki@suse.de>  
Michalis Kargakis <michaliskargakis@gmail.com>  
Michel Lespinasse <>walken@google.com>  
Mickael Kerjean <mickael.kerjean@gmail.com>  
Mickey Reiss <mickeyreiss@gmail.com>  
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>  
Miguel Acero <acero@google.com>  
Miguel Mendez <stxmendez@gmail.com>  
Miguel Molina <hi@mvader.me>  
Mihai Borobocea <MihaiBorobocea@gmail.com>  
Mihai Moldovan <ionic@ionic.de>  
Mihai Todor <todormihai@gmail.com>  
Mihail Minaev <minaev.mike@gmail.com>  
Mikael Tillenius <mikti42@gmail.com>  
Mike Andrews <mra@xoba.com>  
Mike Appleby <mike@app.leby.org>  
Mike Danese <mikedanese@google.com>  
Mike Houston <mike@kothar.net>  
Mike Kabischev <kabischev@gmail.com>  
Mike Rosset <mike.rosset@gmail.com>  
Mike Samuel <mikesamuel@gmail.com>  
Mike Solomon <msolo@gmail.com>  
Mike Strosaker <strosake@us.ibm.com>  
Mike Tsao <mike@sowbug.com>  
Mike Wiacek <mjwiacek@google.com>  
Mikhail Fesenko <proggga@gmail.com>  
Mikhail Gusarov <dottedmag@dottedmag.net>  
Mikhail Panchenko <m@mihasya.com>  
Miki Tebeka <miki.tebeka@gmail.com>  
Mikio Hara <mikioh.mikioh@gmail.com>  
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>  
Mikoaj Baranowski <mikolajb@gmail.com>  
Milan Knezevic <milan.knezevic@mips.com>  
Milan Patel <bicelot3@gmail.com>  
Milutin Jovanovic <jovanovic.milutin@gmail.com>  
MinJae Kwon <mingrammer@gmail.com>  
Miquel Sabat Sol <mikisabate@gmail.com>  
Mirko Hansen <baaazen@gmail.com>  
Miroslav Genov <mgenov@gmail.com>  
Misty De Meo <mistydemeo@gmail.com>  
Mohit Agarwal <mohit@sdf.org>  
Mohit kumar Bajoria <mohitbajo36@gmail.com>

Mohit Verma <vmohit.93@gmail.com>  
Momchil Velikov <momchil.velikov@gmail.com>  
Monis Khan <mkhan@redhat.com>  
Monty Taylor <mordred@inaugust.com>  
Moritz Fain <moritz@fain.io>  
Moriyoshi Koizumi <mozo@mozo.jp>  
Morten Siebuhr <sbhr@sbhr.dk>  
Mshe van der Sterre <moshevds@gmail.com>  
Mostyn Bramley-Moore <mostyn@antipode.se>  
Mrunal Patel <mrunalp@gmail.com>  
Muhammad Falak R Wani <falakreyaz@gmail.com>  
Muhammed Uluyol <uluyol0@gmail.com>  
Muir Manders <muir@mnd.rs>  
Mukesh Sharma <sharma.mukesh439@gmail.com>  
Mura Li <mura\_li@castech.com.tw>  
Mykhailo Lesyk <mikhail@lesyk.org>  
Naman Aggarwal <aggarwal.nam@gmail.com>  
Nan Deng <monnand@gmail.com>  
Nao Yonashiro <owan.orisano@gmail.com>  
Naoki Kanatani <k12naoki@gmail.com>  
Nate Wilkinson <nathanwilk7@gmail.com>  
Nathan Cantelmo <n.cantelmo@gmail.com>  
Nathan Caza <mastercactus@gmail.com>  
Nathan Dias <nathan.dias@orijtech.com>  
Nathan Fiscoletti <nathan.fiscoletti@vrazo.com>  
Nathan Humphreys <nkhumphreys@gmail.com>  
Nathan John Youngman <nj@nathany.com>  
Nathan Otterness <otterness@cs.unc.edu>  
Nathan P Finch <nate.finch@gmail.com>  
Nathan VanBenschoten <nvanbenschoten@gmail.com>  
Nathan Youngman <git@nathany.com>  
Nathan(yinian) Hu <nathanhu@google.com>  
Nathaniel Cook <nvcook42@gmail.com>  
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>  
Neeilan Selvalingam <neeilan96@gmail.com>  
Neelesh Chandola <neelesh.c98@gmail.com>  
Neil Lyons <nwjlyons@googlemail.com>  
Neuman Vong <neuman.vong@gmail.com>  
Neven Sajko <nsajko@gmail.com>  
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>  
Niall Sheridan <nsheridan@gmail.com>  
Nic Day <nic.day@me.com>  
Nicholas Katsaros <nick@nickkatsaros.com>  
Nicholas Maniscalco <nicholas@maniscalco.com>  
Nicholas Ng <nickng@nickng.io>  
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>  
Nicholas Sullivan <nicholas.sullivan@gmail.com>  
Nicholas Waples <nwaples@gmail.com>

Nick Anthony <Liberatys@outlook.com>  
Nick Cooper <nmvc@google.com>  
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>  
Nick Harper <nharper@google.com>  
Nick Kubala <nkubala@google.com>  
Nick Leli <nicholasleli@gmail.com>  
Nick Miyake <nmiyake@users.noreply.github.com>  
Nick Patavalis <nick.patavalis@gmail.com>  
Nick Petroni <npetroni@cs.umd.edu>  
Nick Robinson <nrobinson13@gmail.com>  
Nick Smolin <nick27surgut@gmail.com>  
Nicolas BRULEZ <n.brulez@gmail.com>  
Nicolas Kaiser <nikai@nikai.net>  
Nicolas Owens <mischief@offblast.org>  
Nicolas S. Dade <nic.dade@gmail.com>  
Niek Sanders <niek.sanders@gmail.com>  
Niels Widger <niels.widger@gmail.com>  
Nigel Kerr <nigel.kerr@gmail.com>  
Nigel Tao <nigeltao@golang.org>  
Nik Nyby <nnyby@columbia.edu>  
Nikhil Benesch <nikhil.benesch@gmail.com>  
Nikita Gillmann <nikita@n0.is> <ng0@n0.is>  
Nikita Kryuchkov <nkryuchkov10@gmail.com>  
Nikita Vanyasin <nikita.vanyasin@gmail.com>  
Niklas Schnelle <niklas.schnelle@gmail.com>  
Niko Dziemba <niko@dziemba.com>  
Nikolay Turpitko <nikolay@turpitko.com>  
Nikson Kanti Paul <nikson.sust@gmail.com>  
Nils Larsgrd <nilsmagnus@gmail.com>  
Nir Soffer <nirsof@gmail.com>  
Niranjan Godbole <niranjan8192@gmail.com>  
Nishanth Shanmugham <nishanth.gerrard@gmail.com>  
Noah Campbell <noahcampbell@gmail.com>  
Noah Goldman <noahg34@gmail.com>  
Noble Johnson <noblepoly@gmail.com>  
Nodir Turakulov <nodir@google.com>  
Noel Georgi <git@frezbo.com>  
Norberto Lopes <nlopes.ml@gmail.com>  
Norman B. Lancaster <qbradq@gmail.com>  
Nuno Cruces <ncruces@users.noreply.github.com>  
Obeyda Djefal <djefobey@gmail.com>  
Odin Ugedal <odin@ugedal.com>  
Oleg Bulatov <dmage@yandex-team.ru>  
Oleg Vakheta <helginet@gmail.com>  
Oleku Konko <oleku.konko@gmail.com>  
Oling Cat <olingcat@gmail.com>  
Oliver Hookins <ohookins@gmail.com>  
Oliver Powell <oliverpowell84@gmail.com>

Oliver Stenbom <ostenbom@pivotal.io>  
Oliver Tonnhofer <olt@bogsoft.com>  
Olivier Antoine <olivier.antoine@gmail.com>  
Olivier Duperray <duperray.olivier@gmail.com>  
Olivier Poitrey <rs@dailymotion.com>  
Olivier Saingre <osaingre@gmail.com>  
Omar Jarjur <ojarjur@google.com>  
Oryan Moshe <iamoryanmoshe@gmail.com>  
Osamu TONOMORI <osamingo@gmail.com>  
zgr Kesim <oec-go@kesim.org>  
Pablo Caderno <kaderno@gmail.com>  
Pablo Lalloni <plalloni@gmail.com>  
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>  
Pablo Santiago Blum de Aguiar <scorphus@gmail.com>  
Padraig Kitterick <padraigkitterick@gmail.com>  
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>  
Panos Georgiadis <pgeorgiadis@suse.de>  
Pantelis Sampaziotis <psampaz@gmail.com>  
Paolo Giarrusso <p.giarrusso@gmail.com>  
Paolo Martini <mrtnpaolo@gmail.com>  
Parker Moore <parkrmoore@gmail.com>  
Parminder Singh <parmsingh101@gmail.com>  
Pascal Dierich <pascal@pascaldierich.com>  
Pascal S. de Kloe <pascal@quies.net>  
Paschalis Tsilias <paschalis.tsilias@gmail.com>  
Pasi Thkp <pasi.tahkapaa@gmail.com>  
Pat Moroney <pat@pat.email>  
Patrick Barker <barkerp@vmware.com>  
Patrick Crosby <patrick@stathat.com>  
Patrick Gavlin <pgavlin@gmail.com>  
Patrick Higgins <patrick.allen.higgins@gmail.com>  
Patrick Lee <pattyshack101@gmail.com>  
Patrick Mzard <patrick@mezard.eu>  
Patrick Mylund Nielsen <patrick@patrickmn.com>  
Patrick Pelletier <pp.pelletier@gmail.com>  
Patrick Riley <pfr@google.com>  
Patrick Smith <pat42smith@gmail.com>  
Patrik Lundin <patrik@sigterm.se>  
Paul A Querna <paul.querna@gmail.com>  
Paul Borman <borman@google.com>  
Paul Boyd <boyd.paul2@gmail.com>  
Paul Chang <paulchang@google.com>  
Paul D. Weber <x0bdev@gmail.com>  
Paul Hammond <paul@paulhammond.org>  
Paul Hankin <paulhankin@google.com>  
Paul Jolly <paul@myitcv.org.uk>  
Paul Lalonde <paul.a.lalonde@gmail.com>  
Paul M Furley <paul@paulfurley.com>

Paul Marks <pmarks@google.com>  
Paul Meyer <paul.meyer@microsoft.com>  
Paul Nasrat <pnasrat@google.com>  
Paul PISCUC <paul.piscuc@gmail.com>  
Paul Querna <pquerna@apache.org>  
Paul Rosania <paul.rosania@gmail.com>  
Paul Ruest <pruest@gmail.com>  
Paul Sbarra <Sbarra.Paul@gmail.com>  
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>  
Paul Tyng <paul@paultyng.net>  
Paul van Brouwershaven <paul@vanbrouwershaven.com>  
Paul Wankadia <junyer@google.com>  
Paulo Casaretto <pcasaretto@gmail.com>  
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>  
Paulo Gomes <paulo.gomes.uk@gmail.com>  
Pavel Paulau <pavel.paulau@gmail.com>  
Pavel Zinovkin <pavel.zinovkin@gmail.com>  
Pavlo Sumkin <ymkins@gmail.com>  
Pawel Knap <pawelknap88@gmail.com>  
Pawel Szczur <filemon@google.com>  
Pei Xian Chee <luciolas1991@gmail.com>  
Percy Wegmann <ox.to.a.cart@gmail.com>  
Perry Abbott <perry.j.abbott@gmail.com>  
Petar Dambovaliev <petar.atanasov.1987@gmail.com>  
Petar Maymoukov <petarm@gmail.com>  
Peter Armitage <peter.armitage@gmail.com>  
Peter Bourgon <peter@bourgon.org>  
Peter Collingbourne <pcc@google.com>  
Peter Conerly <pconerly@gmail.com>  
Peter Dotchev <dotchev@gmail.com>  
Peter Froehlich <peter.hans.froehlich@gmail.com>  
Peter Gonda <pgonda@google.com>  
Peter Hoyes <pahoyes@gmail.com>  
Peter Kleiweg <pkleiweg@xs4all.nl>  
Peter McKenzie <petermck@google.com>  
Peter Moody <pmoody@uber.com>  
Peter Morjan <pmorjan@gmail.com>  
Peter Mundy <go.peter.90@gmail.com>  
Peter Nguyen <peter@mictis.com>  
Pter Surnyi <speter.go1@gmail.com>  
Pter Szab <pts@google.com>  
Pter Szilgyi <peterke@gmail.com>  
Peter Teichman <pteichman@fastly.com>  
Peter Tseng <ptseng@squareup.com>  
Peter Waldschmidt <peter@waldschmidt.com>  
Peter Waller <peter.waller@gmail.com>  
Peter Weinberger <pjw@golang.org>  
Peter Williams <pwil3058@gmail.com>

Peter Wu <pwu@cloudflare.com>  
Peter Zhang <i@ddatsh.com>  
Petr Jedin <petr.jediny@gmail.com>  
Petrica Voicu <pvoicu@paypal.com>  
Phil Pearl <philip.j.r.pearl@gmail.com>  
Phil Pennock <pdp@golang.org>  
Philip Brgesen <philip.brgesen@gmail.com>  
Philip Brown <phil@bolthole.com>  
Philip Hofer <phofer@umich.edu>  
Philip K. Warren <pkwarren@gmail.com>  
Philip Nelson <me@pnelson.ca>  
Philipp Stephani <phst@google.com>  
Pierre Carru <pierre.carru@eshard.com>  
Pierre Durand <pierredurand@gmail.com>  
Pierre Prinetti <pierreprinetti@gmail.com>  
Pierre Roullon <pierre.roullon@gmail.com>  
Piers <google@helloworldpro>  
Pieter Droogendijk <pieter@binky.org.uk>  
Pietro Gagliardi <pietro10@mac.com>  
Piyush Mishra <piyush@codeitout.com>  
Plekhanov Maxim <kishtatix@gmail.com>  
Polina Osadcha <polliosa@google.com>  
Pontus Leitzler <leitzler@gmail.com>  
Povilas Versockas <p.versockas@gmail.com>  
Prasanga Siripala <pj@pjeps.com.au>  
Prasanna Swaminathan <prasanna@mediamath.com>  
Prashant Agrawal <prashant.a.vjti@gmail.com>  
Prashant Varanasi <prashant@prashantv.com>  
Praveen Kumar <praveen+git@kumar.in>  
Pravendra Singh <hackpravj@gmail.com>  
Preetam Jinka <pj@preet.am>  
Pure White <wu.purewhite@gmail.com>  
Qais Patankar <qaisjp@gmail.com>  
Qiuxuan Zhu <ilsh1022@gmail.com>  
Quan Tran <qeed.quan@gmail.com>  
Quan Yong Zhai <qyzhai@gmail.com>  
Quentin Perez <qperez@ocs.online.net>  
Quentin Renard <contact@asticode.com>  
Quentin Smith <quentin@golang.org>  
Quey-Liang Kao <s101062801@m101.nthu.edu.tw>  
Quinn Slack <sqs@sourcegraph.com>  
Quinten Yearsley <qyearsley@chromium.org>  
Quoc-Viet Nguyen <afelion@gmail.com>  
Radek Sohlich <sohlich@gmail.com>  
Radu Berinde <radu@cockroachlabs.com>  
Rafal Jeczalik <rjeczalik@gmail.com>  
Raghavendra Nagaraj <jamdagni86@gmail.com>  
Rahul Chaudhry <rahulchaudhry@chromium.org>

Raif S. Naffah <go@naffah-raif.name>  
Rajat Goel <rajat.goel2010@gmail.com>  
Rajath Agasthya <rajathagasthya@gmail.com>  
Rajender Reddy Kompally <rajenderreddykompally@gmail.com>  
Ralph Corderoy <ralph@inputplus.co.uk>  
Ramazan AYYILDIZ <rayyildiz@gmail.com>  
Ramesh Dharan <dharan@google.com>  
Raph Levien <raph@google.com>  
Raphael Geronimi <raphael.geronimi@gmail.com>  
Raul Silvera <rsilvera@google.com>  
Ravil Bikbulatov <weeellz12@gmail.com>  
RaviTeja Pothana <ravi.tezu@gmail.com>  
Ray Tung <rtung@thoughtworks.com>  
Raymond Kazlauskas <raima220@gmail.com>  
Rebecca Stambler <rstambler@golang.org>  
Reilly Watson <reillywatson@gmail.com>  
Reinaldo de Souza Jr <juniorz@gmail.com>  
Remi Gillig <remigillig@gmail.com>  
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>  
Ren Ogaki <re.yuz77777@gmail.com>  
Rens Rikkerink <Ikkerens@users.noreply.github.com>  
Rhys Hiltner <rhys@justin.tv>  
Ricardo Padilha <ricardospadilha@gmail.com>  
Ricardo Seriani <ricardo.seriani@gmail.com>  
Richard Barnes <rlb@ipv.sx>  
Richard Crowley <r@rcrowley.org>  
Richard Dingwall <rdingwall@gmail.com>  
Richard Eric Gavaletz <gavaletz@gmail.com>  
Richard Gibson <richard.gibson@gmail.com>  
Richard Miller <miller.research@gmail.com>  
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>  
Richard Ulmer <codesoap@mailbox.org>  
Richard Wilkes <wilkes@me.com>  
Rick Arnold <rickarnoldjr@gmail.com>  
Rick Hudson <rlh@golang.org>  
Rick Sayre <whorfin@gmail.com>  
Rijnard van Tonder <rvantonder@gmail.com>  
Riku Voipio <riku.voipio@linaro.org>  
Risto Jaakko Saareln <rsaareln@gmail.com>  
Rob Earhart <earhart@google.com>  
Rob Findley <rfindley@google.com>  
Rob Norman <rob.norman@infinitycloud.com>  
Rob Phoenix <rob@robphoenix.com>  
Rob Pike <r@golang.org>  
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>  
Robert Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>  
Robert Dinu <r@varp.se>  
Robert Figueiredo <robfig@gmail.com>



Robert Griesemer <gri@golang.org>  
Robert Hencke <robert.hencke@gmail.com>  
Robert Iannucci <iannucci@google.com>  
Robert Kuska <rkuska@gmail.com>  
Robert Obryk <robryk@gmail.com>  
Robert Sesek <rsesek@google.com>  
Robert Snedegar <roberts@google.com>  
Robert Stepanek <robert.stepanek@gmail.com>  
Robert van Gent <rvangent@google.com>  
Robert-Andr Mauchin <zebob.m@gmail.com>  
Roberto Clapis <robclap8@gmail.com>  
Roberto Selbach <roberto@selbach.ca>  
Robin Eklind <r.eklind.87@gmail.com>  
Robin Zhong <robin@robinzhong.co>  
Rodolfo Carvalho <rhcarvalho@gmail.com>  
Rodolfo Rodriguez <rodolfobgibson@gmail.com>  
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>  
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>  
Roger Pau Monn <royger@gmail.com>  
Roger Peppe <rogpeppe@gmail.com>  
Rohan Challa <rohan@golang.org>  
Rohan Verma <rohanverma2004@gmail.com>  
Rohith Ravi <entombedvirus@gmail.com>  
Roland Illig <roland.illig@gmx.de>  
Roland Shoemaker <rolandshoemaker@gmail.com>  
Romain Bauge <romain.bauge@elwinar.com>  
Roman Budnikov <romanyx90@yandex.ru>  
Roman Kollr <roman.kollar.0@gmail.com>  
Roman Shchekin <mrqtros@gmail.com>  
Ron Hashimoto <mail@h2so5.net>  
Ron Minnich <rminnich@gmail.com>  
Ross Chater <rdchater@gmail.com>  
Ross Kinsey <rossikinsey@gmail.com>  
Ross Light <light@google.com> <rlight2@gmail.com>  
Ross Smith II <ross@smithii.com>  
Rowan Marshall <rowanajmarshall@gmail.com>  
Rowan Worth <sqweek@gmail.com>  
Rudi Kramer <rudi.kramer@gmail.com>  
Rui Ueyama <ruiui@google.com>  
Ruixin Bao <ruixin.bao@ibm.com>  
Ruslan Nigmatullin <elessar@dropbox.com>  
Russ Cox <rsc@golang.org>  
Russell Haering <russellhaering@gmail.com>  
Ryan Bagwell <ryanbagwell@outlook.com>  
Ryan Barrett <ryanb@google.com>  
Ryan Boehning <ryan.boehning@apcera.com>  
Ryan Brown <ribrd@b@gmail.com>  
Ryan Canty <jrcanty@gmail.com>

Ryan Dahl <ry@tinyclouds.org>  
Ryan Hitchman <hitchmanr@gmail.com>  
Ryan Lower <rpjlower@gmail.com>  
Ryan Roden-Corrent <ryan@rcorre.net>  
Ryan Seys <ryan@ryanseys.com>  
Ryan Slade <ryanslade@gmail.com>  
Ryan Zhang <ryan.zhang@docker.com>  
Ryoichi KATO <ryo1kato@gmail.com>  
Ryuji Iwata <qt.luigi@gmail.com>  
Ryuma Yoshida <ryuma.y1117@gmail.com>  
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>  
S.alar Onur <caglar@10ur.org>  
Sabin Mihai Rapan <sabin.rapan@gmail.com>  
Sad Pencil <qh06@qq.com>  
Sai Cheemalapati <saicheems@google.com>  
Sakeven Jiang <jc5930@sina.cn>  
Salmn Aljammz <s@0x65.net>  
Sam Arnold <sarnold64@bloomberg.net>  
Sam Boyer <tech@samboyer.org>  
Sam Chen <chenxsan@gmail.com>  
Sam Cross <samgcdev@gmail.com>  
Sam Ding <samding@ca.ibm.com>  
Sam Hug <samuel.b.hug@gmail.com>  
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>  
Sam Whited <sam@samwhited.com>  
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>  
Sami Commerot <samic@google.com>  
Sami Pnknen <sami.ponkanen@gmail.com>  
Samuel Kelemen <SCKelemen@users.noreply.github.com>  
Samuel Tan <samueltan@google.com>  
Samuele Pedroni <pedronis@lucediaruna.net>  
Sander van Harmelen <sander@vanharmelen.nl>  
Sanjay Menakuru <balasanjay@gmail.com>  
Santhosh Kumar Tekuri <santhosh.tekuri@gmail.com>  
Sarah Adams <shadams@google.com>  
Sardorbek Pulatov <sardorbek.pulatov@outlook.com>  
Sascha Brawer <sascha@brawer.ch>  
Sasha Lionheart <lionhearts@google.com>  
Sasha Sobol <sasha@scaledinference.com>  
Scott Barron <scott.barron@github.com>  
Scott Bell <scott@sctsm.com>  
Scott Crunkleton <crunk1@gmail.com>  
Scott Ferguson <scottwferg@gmail.com>  
Scott Lawrence <bytbox@gmail.com>  
Scott Mansfield <smansfield@netflix.com>  
Scott Ragan <ragansa@fb.com>  
Scott Schwartz <scotts@golang.org>  
Scott Van Woudenberg <scottvw@google.com>

Sean Burford <sburford@google.com>  
Sean Chen <oohcode@gmail.com>  
Sean Chittenden <seanc@joyent.com>  
Sean Christopherson <sean.j.christopherson@intel.com>  
Sean Dolphin <Sean.Dolphin@kpcompass.com>  
Sean Harger <sharger@google.com>  
Sean Liao <seankhliao@gmail.com>  
Sean Rees <sean@erifax.org>  
Sebastiaan van Stijn <github@gone.nl>  
Sebastian Chlopecki <sebsebmc@gmail.com>  
Sebastian Kinne <skinne@google.com>  
Sebastian Schmidt <yath@google.com>  
Sebastien Binet <seb.binet@gmail.com>  
Sbastien Paolacci <sebastien.paolacci@gmail.com>  
Sebastien Williams-Wynn <sebastien@cytora.com>  
Segev Finer <segev208@gmail.com>  
Seiji Takahashi <timaki.st@gmail.com>  
Sergei Lemeshkin <sergeilem@gmail.com>  
Sergei Skorobogatov <skorobo@rambler.ru>  
Sergei Zagurskii <gvozdoder@gmail.com>  
Sergey 'SnakE' Gromov <snake.scaly@gmail.com>  
Sergey Arseev <sergey.arseev@intel.com>  
Sergey Dobrodey <sergey.dobrodey@synesis.ru>  
Sergey Frolov <sfrolov@google.com>  
Sergey Glushchenko <gsserge@gmail.com>  
Sergey Ivanov <ser1325@gmail.com>  
Sergey Lukjanov <me@slukjanov.name>  
Sergey Mishin <sergymishine@gmail.com>  
Sergey Mudrik <sergey.mudrik@gmail.com>  
Sergey Semin <gray12511@gmail.com>  
Sergey Yanykin <syanykin@ozon.ru>  
Sergio Luis O. B. Correia <sergio@correia.cc>  
Sergiusz Bazanski <bazanski@gmail.com>  
Serhat Giydiren <serhatgiydiren@gmail.com>  
Serhii Aheienko <serhii.aheienko@gmail.com>  
Seth Hoenig <seth.a.hoenig@gmail.com>  
Seth Vargo <sethvargo@gmail.com>  
Shahar Kohanim <skohanim@gmail.com>  
Shamil Garatuev <garatuev@gmail.com>  
Shane Hansen <shanemhansen@gmail.com>  
Shang Jian Ding <sding3@ncsu.edu>  
Shaozhen Ding <dsz0111@gmail.com>  
Shaquille Wyan Que <shaqywyuan@gmail.com>  
Shaun Dunning <shaun.dunning@uservoice.com>  
Shawn Elliott <sellott@microsoft.com>  
Shawn Ledbetter <sledbetter@google.com>  
Shawn Smith <shawn.p.smith@gmail.com>  
Shawn Walker-Salas <shawn.walker@oracle.com>

Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>  
Shengjing Zhu <zs950618@gmail.com>  
Shengyu Zhang <shengyu.zhang@chaitin.com>  
Shi Han Ng <shihanng@gmail.com>  
Shijie Hao <haormj@gmail.com>  
Shinji Tanaka <shinji.tanaka@gmail.com>  
Shintaro Kaneko <kaneshin0120@gmail.com>  
Shivakumar GN <shivakumar.gn@gmail.com>  
Shivani Singhal <shivani.singhal2804@gmail.com>  
Shivansh Rai <shivansh@freebsd.org>  
Shivashis Padhi <shivashispadhi@gmail.com>  
Shubham Sharma <shubham.sha12@gmail.com>  
Shun Fan <sfan@google.com>  
Silvan Jegen <s.jegen@gmail.com>  
Simarpreet Singh <simar@linux.com>  
Simon Drake <simondrake1990@gmail.com>  
Simon Ferquel <simon.ferquel@docker.com>  
Simon Jefford <simon.jefford@gmail.com>  
Simon Rawet <simon@rawet.se>  
Simon Rozman <simon@rozman.si>  
Simon Thulbourn <simon+github@thulbourn.com>  
Simon Whitehead <chemnova@gmail.com>  
Sina Siadat <siadat@gmail.com>  
Sjoerd Siebinga <sjoerd.siebinga@gmail.com>  
Sokolov Yura <funny.falcon@gmail.com>  
Song Gao <song@gao.io>  
Soojin Nam <jsunam@gmail.com>  
Sren L. Hansen <soren@linux2go.dk>  
Spencer Kocot <spencerkocot@gmail.com>  
Spencer Nelson <s@spenczar.com>  
Spencer Tung <spencertung@google.com>  
Spring Mc <heresy.mc@gmail.com>  
Srdjan Petrovic <spetrovic@google.com>  
Sridhar Venkatakrishnan <sridhar@laddoo.net>  
Srinidhi Kaushik <shrinidhi.kaushik@gmail.com>  
StalkR <stalkr@stalkr.net>  
Stan Schwertly <stan@schwertly.com>  
Stanislav Afanasev <php.progger@gmail.com>  
Steeve Morin <steeve.morin@gmail.com>  
Stefan Baebler <sbaebler@outbrain.com>  
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>  
Stepan Shabalin <neverliberty@gmail.com>  
Stephan Renatus <srenatus@chef.io>  
Stephan Zuercher <zuercher@gmail.com>  
Stphane Travostino <stephane.travostino@gmail.com>  
Stephen Lewis <stephen@sock.org.uk>  
Stephen Lu <steuhs@users.noreply.github.com>  
Stephen Ma <stephenm@golang.org>

Stephen McQuay <stephen@mcquay.me>  
Stephen Searles <stephens2424@gmail.com>  
Stephen Weinberg <stephen@q5comm.com>  
Steve Francia <spf@golang.org>  
Steve Gilbert <stevegilbert23@gmail.com>  
Steve LoFurno <slofurno@gmail.com>  
Steve McCoy <mccoyst@gmail.com>  
Steve Mynott <steve.mynott@gmail.com>  
Steve Newman <snewman@google.com>  
Steve Phillips <elimistev@gmail.com>  
Steve Streeting <steve@stevestreeting.com>  
Steven Buss <sbuss@google.com>  
Steven Elliot Harris <seharris@gmail.com>  
Steven Erenst <stevenerenst@gmail.com>  
Steven Hartland <steven.hartland@multiplay.co.uk>  
Steven Littlebrant <imgroxx@gmail.com>  
Steven Wilkin <stevenwilkin@gmail.com>  
Stuart Jansen <sjansen@buscaluz.org>  
Sue Spence <virtuallysue@gmail.com>  
Sugu Sougoumarane <ssougou@gmail.com>  
Suharsh Sivakumar <suharshs@google.com>  
Sukrit Handa <sukrit.handa@utoronto.ca>  
Sunny <me@darkowlzz.space>  
Suriyaa Sundararuban <suriyaasundararuban@gmail.com>  
Suyash <dextrous93@gmail.com>  
Suzy Mueller <suzmue@golang.org>  
Sven Almgren <sven@tras.se>  
Sven Blumenstein <svbl@google.com>  
Sven Taute <sven.taute@gmail.com>  
Sylvain Zimmer <sylvain@sylvainzimmer.com>  
Syohei YOSHIDA <syohex@gmail.com>  
Szabolcs Nagy <nsz@port70.net>  
Taavi Kivisik <taavi.kivisik@gmail.com>  
Tad Fisher <tadfisher@gmail.com>  
Tad Glines <tad.glines@gmail.com>  
Tadas Valiukas <tadovas@gmail.com>  
Tadeo Kondrak <me@tadeo.ca>  
Taesu Pyo <pyotaesu@gmail.com>  
Tai Le <letientai299@gmail.com>  
Taj Khattrra <taj.khattrra@gmail.com>  
Takashi Matsuo <tmatsuo@google.com>  
Takayoshi Nishida <takayoshi.nishida@gmail.com>  
Takeshi YAMANASHI <9.nashi@gmail.com>  
Takuto Ikuta <tikuta@google.com>  
Takuya Ueda <uedatakuya@gmail.com>  
Tal Shprecher <tshprecher@gmail.com>  
Tams Gulcsi <tgulacsi78@gmail.com>  
Tamir Duberstein <tamird@gmail.com>

Tao Qingyun <qingyunha@gmail.com>  
Tao Shen <shentaoskyking@gmail.com>  
Tao Wang <twang2218@gmail.com>  
Tarmigan Casebolt <tarmigan@gmail.com>  
Taro Aoki <aizu.s1230022@gmail.com>  
Taru Karttunen <taruti@taruti.net>  
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>  
Tatsuya Kaneko <m.ddotx.f@gmail.com>  
Taufiq Rahman <taufiqrx8@gmail.com>  
Teague Cole <tnc1443@gmail.com>  
Ted Kornish <golang@tedkornish.com>  
Tejasvi Nareddy <tejunareddy@gmail.com>  
Terin Stock <terinjokes@gmail.com>  
Terrel Shumway <gopher@shumway.us>  
Tetsuo Kiso <tetsuokiso9@gmail.com>  
Than McIntosh <thanm@google.com>  
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>  
Thanatat Tamtan <acoshift@gmail.com>  
The Hatsune Daishi <nao20010128@gmail.com>  
Thiago Avelino <t@avelino.xxx>  
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>  
Thomas Alan Copeland <talan.copeland@gmail.com>  
Thomas Bonfort <thomas.bonfort@gmail.com>  
Thomas Bouldin <inlined@google.com>  
Thomas Bruyelle <thomas.bruyelle@gmail.com>  
Thomas Bushnell, BSG <tbushnell@google.com>  
Thomas de Zeeuw <thomasdezeeuw@gmail.com>  
Thomas Desrosiers <thomasdesr@gmail.com>  
Thomas Habets <habets@google.com>  
Thomas Kappler <tkappler@gmail.com>  
Thomas Meson <zllak@hycik.org>  
Thomas Symborski <thomas.symborski@gmail.com>  
Thomas Wanielista <tomwans@gmail.com>  
Thorben Krueger <thorben.krueger@gmail.com>  
Thordur Bjornsson <thorduri@secnorth.net>  
Tiago Queiroz <contato@tiago.eti.br>  
Tianji Wu <the729@gmail.com>  
Tianon Gravi <admwiggin@gmail.com>  
Tilman Dilo <tilman.dilo@gmail.com>  
Tim Cooijmans <timcooijmans@gmail.com>  
Tim Cooper <tim.cooper@layeh.com>  
Tim Ebringer <tim.ebringer@gmail.com>  
Tim Heckman <t@heckman.io>  
Tim Henderson <tim.tadh@gmail.com>  
Tim Hockin <thockin@google.com>  
Tim Mhlmann <muhlemmer@gmail.com>  
Tim Swast <swast@google.com>  
Tim Wright <tenortim@gmail.com>

Tim Xu <xiaoxubeii@gmail.com>  
Timmy Douglas <timmyd983@gmail.com>  
Timo Savola <timo.savola@gmail.com>  
Timo Truys <alkaloid.btx@gmail.com>  
Timothy Studd <tim@timstudd.com>  
Tipp Moseley <tipp@google.com>  
Tobias Assarsson <tobias.assarsson@gmail.com>  
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>  
Tobias Klauser <tklauser@distanz.ch>  
Toby Burrell <kurin@google.com>  
Todd Kulesza <tkulesza@google.com>  
Todd Neal <todd@tneal.org>  
Todd Wang <toddwang@gmail.com>  
Tom Anthony <git@tomanthony.co.uk>  
Tom Bergan <tombergan@google.com>  
Tom Heng <zhm20070928@gmail.com>  
Tom Lanyon <tomlanyon@google.com>  
Tom Levy <tomlevy93@gmail.com>  
Tom Limoncelli <tal@whatexit.org>  
Tom Linfoord <tomlinfoord@gmail.com>  
Tom Parkin <tom.parkin@gmail.com>  
Tom Payne <twpayne@gmail.com>  
Tom Szymanski <tgs@google.com>  
Tom Thorogood <me+google@tomthorogood.co.uk>  
Tom Wilkie <tom@weave.works>  
Tomas Dabasinskas <tomas@dabasinskas.net>  
Tommy Schaefer <tommy.schaefer@teecom.com>  
Tomohiro Kusumoto <zabio1192@gmail.com>  
Tomoya Ishizaki <zaq1tomo@gmail.com>  
Tonis Tiigi <tonistiigi@gmail.com>  
Tony Reix <tony.reix@bull.net>  
Tony Walker <walkert.uk@gmail.com>  
Tooru Takahashi <tooru.takahashi134@gmail.com>  
Tor Andersson <tor.andersson@gmail.com>  
Torben Schinke <torben.schinke@neotos.de>  
Tormod Erevik Lea <tormodlea@gmail.com>  
Toshihiro Shiino <shiino.toshihiro@gmail.com>  
Toshiki Shima <hayabusa1419@gmail.com>  
Totoro W <tw19881113@gmail.com>  
Travis Bischel <travis.bischel@gmail.com>  
Travis Cline <travis.cline@gmail.com>  
Trevor Strohman <trevor.strohman@gmail.com>  
Trey Lawrence <lawrence.trey@gmail.com>  
Trey Roessig <trey.roessig@gmail.com>  
Trey Tacon <ttacon@gmail.com>  
Tristan Amini <tamini01@ca.ibm.com>  
Tristan Colgate <tcolgate@gmail.com>  
Tristan Oohry <ooohry@gmail.com>

Tristan Rice <rice@fn.lc>  
Troels Thomsen <troels@thomsen.io>  
Trung Nguyen <trung.n.k@gmail.com>  
Tsuji Daishiro <dram.dt.shonan@gmail.com>  
Tudor Golubenco <tudor.g@gmail.com>  
Tugdual Saunier <tugdual.saunier@gmail.com>  
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>  
Tyler Bui-Palsulich <tpalsulich@google.com>  
Tyler Bunnell <tylerbunnell@gmail.com>  
Tyler Treat <ttreat31@gmail.com>  
Tyson Andre <tysonandre775@gmail.com>  
Tzach Shabtay <tzachshabtay@gmail.com>  
Tzu-Jung Lee <roylee17@currant.com>  
Udalov Max <re.udalov@gmail.com>  
Ugorji Nwoke <ugorji@gmail.com>  
Ulf Holm Nielsen <doktor@dyregod.dk>  
Ulrich Kunitz <uli.kunitz@gmail.com>  
Umang Parmar <umangjparmar@gmail.com>  
Uriel Mangado <uriel@berlinblue.org>  
Urvil Patel <patelurvil38@gmail.com>  
Uttam C Pawar <uttam.c.pawar@intel.com>  
Vadim Grek <vadimprog@gmail.com>  
Vadim Vygonets <unixdj@gmail.com>  
Val Polouchkine <vpolouch@justin.tv>  
Valentin Vidic <vvidic@valentin-vidic.from.hr>  
Vee Zhang <veezhang@126.com> <vveezhang@gmail.com>  
Vega Garcia Luis Alfonso <vegacom@gmail.com>  
Venil Noronha <veniln@vmware.com>  
Veselkov Konstantin <kostozyb@gmail.com>  
Viacheslav Poturaev <vearutop@gmail.com>  
Victor Chudnovsky <vchudnov@google.com>  
Victor Vrantchan <vrancean+github@gmail.com>  
Vignesh Ramachandra <vickyramachandra@gmail.com>  
Vikas Kedia <vikask@google.com>  
Ville Skytt <ville.skytta@iki.fi>  
Vincent Ambo <tazjin@googlemail.com>  
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>  
Vincent Vanackere <vincent.vanackere@gmail.com>  
Vinu Rajashekhar <vinutheraj@gmail.com>  
Vish Subramanian <vish@google.com>  
Vishvananda Ishaya <vishvananda@gmail.com>  
Visweswara R <r.visweswara@gmail.com>  
Vitaly Zdanevich <zdanevich.vitaly@ya.ru>  
Vitor De Mario <vitordemario@gmail.com>  
Vivek Sekhar <vsekhar@google.com>  
Vivian Liang <vliang88@gmail.com>  
Vlad Krasnov <vlad@cloudflare.com>  
Vladimir Evgrafov <evgrafov.vladimir@gmail.com>



Vladimir Kovpak <cn007b@gmail.com>  
Vladimir Kuzmin <vkuzmin@uber.com>  
Vladimir Mihailenco <vladimir.webdev@gmail.com>  
Vladimir Nikishenko <vova616@gmail.com>  
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>  
Vladimir Varankin <nek.narqo@gmail.com>  
Vojtech Bocek <vbocek@gmail.com>  
Volker Dobler <dr.volker.dobler@gmail.com>  
Volodymyr Paprotski <vpaprots@ca.ibm.com>  
W. Trevor King <wking@tremily.us>  
Wade Simmons <wade@wades.im>  
Wagner Riffel <wgriffel@gmail.com>  
Walt Della <walt@javins.net>  
Walter Poupore <wpoupore@google.com>  
Wander Lairson Costa <wcosta@mozilla.com>  
Wang Xuerui <git@xen0n.name>  
Warren Fernandes <warren.f.fernandes@gmail.com>  
Wayne Ashley Berry <wayneashleyberry@gmail.com>  
Wedson Almeida Filho <wedsonaf@google.com>  
Weerasak Chongnguluam <singpor@gmail.com>  
Wi Cngru <crvv.mail@gmail.com>  
Wei Fu <fhfuwei@163.com>  
Wei Guangjing <vcc.163@gmail.com>  
Wei Xiao <wei.xiao@arm.com>  
Wei Xikai <xykwei@gmail.com>  
Weichao Tang <tevic.tt@gmail.com>  
Wembley G. Leach, Jr <wembley.gl@gmail.com>  
Wenlei (Frank) He <wlhe@google.com>  
Wenzel Lowe <lowewenzel@gmail.com>  
Wil Selwood <wselwood@gmail.com>  
Wilfried Teiken <wteiken@google.com>  
Will Beason <willbeason@gmail.com>  
Will Chan <willchan@google.com>  
Will Faught <will.faught@gmail.com>  
Will Morrow <wmorrow.qdt@qualcommdatacenter.com>  
Will Norris <willnorris@google.com>  
Will Storey <will@summercat.com>  
Willem van der Schyff <willemvds@gmail.com>  
William Chan <willchan@chromium.org>  
William Chang <mr.williamchang@gmail.com>  
William Josephson <wjosephson@gmail.com>  
William Orr <will@worrbase.com> <ay1244@gmail.com>  
William Poussier <william.poussier@gmail.com>  
Wisdom Omuya <deafgoat@gmail.com>  
Wu Yunzhou <yunzhouwu@gmail.com>  
Xi Ruoyao <xry23333@gmail.com>  
Xia Bin <snyh@snyh.org>  
Xiangdong Ji <xiangdong.ji@arm.com>

Xing Xing <mikespook@gmail.com>  
Xingqang Bai <bxq2011hust@qq.com>  
Xu Fei <badgangkiller@gmail.com>  
Xudong Zhang <felixmelon@gmail.com>  
Xudong Zheng <7pkvm5aw@slicealias.com>  
Xuyang Kang <xuyangkang@gmail.com>  
Yamagishi Kazutoshi <ykzts@desire.sh>  
Yan Zou <yzou@google.com>  
Yang Hau <vulxj0j8j8@gmail.com>  
Yang Tian <linuxty@gmail.com>  
Yann Hodique <yhodique@google.com>  
Yann Kerherv <yann.kerherve@gmail.com>  
Yann Salan <yannsalaun1@gmail.com>  
Yannic Bonenberger <contact@yannic-bonenberger.com>  
Yao Zhang <lunaria21@gmail.com>  
Yaron de Leeuw <jarondl@google.com>  
Yaroslav Vorobiov <yar.vorobiov@gmail.com>  
Yasha Bubnov <girokompas@gmail.com>  
Yasser Abdolmaleki <yasser@yasser.ca>  
Yasuharu Goto <matope.ono@gmail.com>  
Yasuhiro Matsumoto <mattn.jp@gmail.com>  
Yasuyuki Oka <yasuyk@gmail.com>  
Yazen Shunnar <yazen.shunnar@gmail.com>  
Yestin Sun <ylh@pdx.edu>  
Yesudeep Mangalapilly <yesudeep@google.com>  
Yissakhar Z. Beck <yissakhar.beck@gmail.com>  
Yo-An Lin <yoanlin93@gmail.com>  
Yohei Takeda <yo.tak0812@gmail.com>  
Yongjian Xu <i3dmaster@gmail.com>  
Yorman Arias <cixtords@gmail.com>  
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>  
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>  
Yosuke Akatsuka <yosuke.akatsuka@gmail.com>  
Yu Heng Zhang <annita.zhang@cn.ibm.com>  
Yu Xuan Zhang <zyxsh@cn.ibm.com>  
Yuichi Kishimoto <yk2220s@gmail.com>  
Yuichi Nishiwaki <yuichi.nishiwaki@gmail.com>  
Yuji Yaginuma <yuuji.yaginuma@gmail.com>  
Yuki OKUSHI <huyuumi.dev@gmail.com>  
Yuki Yugui Sonoda <yugui@google.com>  
Yukihiro Nishinaka <6elpinal@gmail.com>  
Yury Smolsky <yury@smolsky.by>  
Yusuke Kagiwada <block.rxckin.beats@gmail.com>  
Yuusei Kuwana <kuwana@kumama.org>  
Yuval Pavel Zholkover <paulzhol@gmail.com>  
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>  
Zac Bergquist <zbergquist99@gmail.com>  
Zach Bintliff <zbintliff@gmail.com>

Zach Gershman <zachgersh@gmail.com>  
Zach Jones <zachj1@gmail.com>  
Zachary Amsden <zach@thundertoken.com>  
Zachary Gershman <zgershman@pivotal.io>  
Zak <zrjknill@gmail.com>  
Zakatell Kanda <hi@zkanda.io>  
Zellyn Hunter <zellyn@squareup.com> <zellyn@gmail.com>  
Zev Goldstein <zev.goldstein@gmail.com>  
Zhang Boyang <zhangboyang.id@gmail.com>  
Zheng Dayu <davidzheng23@gmail.com>  
Zheng Xu <zheng.xu@arm.com>  
Zhengyu He <hzy@google.com>  
Zhongpeng Lin <zplin@uber.com>  
Zhongtao Chen <chenzhongtao@126.com>  
Zhongwei Yao <zhongwei.yao@arm.com>  
Zhou Peng <p@ctruple.cn>  
Ziad Hatahet <hatahet@gmail.com>  
Ziheng Liu <lzhfromustc@gmail.com>  
Zorion Arrizabalaga <zorionk@gmail.com>  
<a.maksadbek@gmail.com>  
<max.faceless.frei@gmail.com>  
<hagen1778@gmail.com>  
<tbunyk@gmail.com>  
<faxriddinjon@gmail.com>  
<zs349596@gmail.com>  
<bronze1man@gmail.com>  
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jar/javax/activation/MimeTypeParameterList.java
```

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*/
/*
* @(#)CommandMap.java 1.19 05/11/16
*
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*/
```

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 */
/*
 * @(#)MimeTypeParseException.java 1.6 05/11/16
 *
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 */
```

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```
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jar/javax/activation/MimeTypeParseException.java
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/*
* @(#)DataHandler.java 1.39 05/11/16
*
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*/
```

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```

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*/
/*
* @(#)UnsupportedDataException.java 1.9 05/11/16
*
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*/
```

Found in path(s):

```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
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```

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/*
* @(#)FileTypeMap.java 1.8 05/11/16
*
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*/
```

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```
*/opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
jar/javax/activation/FileTypeMap.java
```

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```
* [name of copyright owner]
*/
/*
* @(#)MimeType.java 1.19 05/11/16
*
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*/
```

Found in path(s):

```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
jar/javax/activation/MimeType.java
```

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```

```
*/
/*
* @(#)MimeTypeEntry.java 1.4 05/11/16
*
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*/
```

Found in path(s):

```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
jar/com/sun/activation/registries/MimeTypeEntry.java
```

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/*
* @(#)TextViewer.java 1.9 05/11/16
*
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*/
```

Found in path(s):

```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
jar/com/sun/activation/viewers/TextViewer.java
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/*
```

\* @(#)FileDataSource.java 1.9 05/11/16  
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\* /opt/cola/permits/1200523838\_1654022813.457056/0/activation-1-1-sources-11-jar/javax/activation/FileDataSource.java

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\* @(#)LogSupport.java 1.4 05/11/16  
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\* /opt/cola/permits/1200523838\_1654022813.457056/0/activation-1-1-sources-11-jar/com/sun/activation/registries/LogSupport.java

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/*
* @(#)DataContentHandler.java 1.16 05/11/16
*
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*/
```

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```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
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```

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/*
* @(#)ActivationDataFlavor.java 1.14 05/11/16
*
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*/
```

\*/

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\* /opt/cola/permits/1200523838\_1654022813.457056/0/activation-1-1-sources-11-jar/javax/activation/ActivationDataFlavor.java

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\* @(#)MimeTypeFile.java 1.8 05/11/16

\*

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\* /opt/cola/permits/1200523838\_1654022813.457056/0/activation-1-1-sources-11-jar/com/sun/activation/registries/MimeTypeFile.java

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/*
* @(#)TextEditor.java 1.8 05/11/16
*
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*/
```

Found in path(s):

```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
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/*
* @(#)MailcapFile.java 1.23 05/11/16
*
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*/
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```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
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```

```
*/
```

```
/*
```

```
* @(#)MailcapTokenizer.java 1.6 05/11/16
```

```
*
```

```
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```

```
*/
```

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```
* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
jar/com/sun/activation/registries/MailcapTokenizer.java
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@(#)package.html 1.1 05/11/16

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/\*

\* @(#)MailcapParseException.java 1.4 05/11/16

\*

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jar/com/sun/activation/registries/MailcapParseException.java



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/*
 * @(#)MimetypesFileTypeMap.java 1.17 05/11/16
 *
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 */
```

Found in path(s):

```
*/opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
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* @(#)DataSource.java 1.11 05/11/16
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*/
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* /opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
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*/
/*
* @(#)ImageViewer.java 1.8 05/11/16
*
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*/
```

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```
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jar/com/sun/activation/viewers/ImageViewer.java
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* fields enclosed by brackets "[]" replaced with your
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*/
/*
* @(#)CommandObject.java 1.9 05/11/16
*
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*/
```

Found in path(s):

```
*/opt/cola/permits/1200523838_1654022813.457056/0/activation-1-1-sources-11-
jar/javax/activation/CommandObject.java
```

## 1.461 python 3.7.3

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1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes	
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1.6	1.5.2	2000	CNRI	no	
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-----

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A C-program for MT19937, with initialization improved 2002/1/26.

Coded by Takuji Nishimura and Makoto Matsumoto.

Before using, initialize the state by using `init_genrand(seed)`  
or `init_by_array(init_key, key_length)`.

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<http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/emt.html>

email: m-mat @ math.sci.hiroshima-u.ac.jp (remove space)

Sockets

-----

The `:mod:`socket`` module uses the functions, `:func:`getaddrinfo``, and  
`:func:`getnameinfo``, which are coded in separate source files from the WIDE  
Project, <http://www.wide.ad.jp/>. ::

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Asynchronous socket services  
-----

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UUencode and UUdecode functions

-----

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Modified by Jack Jansen, CWI, July 1995:

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

## XML Remote Procedure Calls

-----

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

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`test_epoll`

-----

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Select kqueue

-----

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SipHash24

-----

The file `:file:`Python/pyhash.c`` contains Marek Majkowski' implementation of



Dan Bernstein's SipHash24 algorithm. The contains the following note::

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Original location:

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

Solution inspired by code from:

Samuel Neves (supercop/crypto\_auth/siphash24/little)

djb (supercop/crypto\_auth/siphash24/little2)

Jean-Philippe Aumasson (<https://131002.net/siphash/siphash24.c>)

strtod and dtoa

-----

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

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cfuhash

-----

The implementation of the hash table used by the `:mod:`tracemalloc`` is based on the cfuhash project::

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\* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/ReflectionAccessor.java

\* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/UnsafeReflectionAccessor.java

\* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/JavaVersion.java

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jar/com/google/gson/internal/bind/CollectionTypeAdapterFactory.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/TypeAdapters.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/JsonTreeReader.java
* /opt/cola/permits/1108597571_1606176527.27/0/gson-2-8-6-sources-1-
jar/com/google/gson/internal/bind/ArrayTypeAdapter.java
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jar/com/google/gson/internal/bind/ObjectTypeAdapter.java
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jar/com/google/gson/internal/bind/MapTypeAdapterFactory.java
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jar/com/google/gson/TypeAdapterFactory.java
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jar/com/google/gson/internal/bind/ReflectiveTypeAdapterFactory.java
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- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonDeserializer.java
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- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/Excluder.java
- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonSerializationContext.java
- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonArray.java
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- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldNamingPolicy.java
- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldNamingStrategy.java

\* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/DefaultDateTypeAdapter.java  
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- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/TreeTypeAdapter.java

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- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/FieldAttributes.java
- \* /opt/cola/permits/1108597571\_1606176527.27/0/gson-2-8-6-sources-1-jar/com/google/gson/JsonParser.java

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<[eric@debian.org](mailto:eric@debian.org)>, James Westby <[jw+debian@jameswestby.net](mailto:jw+debian@jameswestby.net)>

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=====

LIBGCRYPT Werner Koch 2001-06-07

Assigns past and future changes.

Assignment for future changes terminated on 2012-12-04.

wk@gnupg.org

Designed and implemented Libgrypt.

GNUPG Matthew Skala 1998-08-10

Disclaims changes.

mskala@ansuz.sooke.bc.ca

Wrote cipher/twofish.c.

GNUPG Natural Resources Canada 1998-08-11

Disclaims changes by Matthew Skala.

GNUPG Michael Roth Germany 1998-09-17

Assigns changes.

mroth@nessie.de

Wrote cipher/des.c.

Changes and bug fixes all over the place.

GNUPG Niklas Hernaeus 1998-09-18

Disclaims changes.

nh@df.lth.se

Weak key patches.

GNUPG Rmi Guyomarch 1999-05-25

Assigns past and future changes. (g10/compress.c, g10/encr-data.c,  
g10/free-packet.c, g10/mdfilter.c, g10/plaintext.c, util/iobuf.c)

rguyom@mail.dotcom.fr

ANY g10 Code GmbH 2001-06-07

Assignment for future changes terminated on 2012-12-04.

Code marked with ChangeLog entries of g10 Code employees.

LIBGCRYPT Timo Schulz 2001-08-31

Assigns past and future changes.  
twoaday@freakmail.de

LIBGCRYPT Simon Josefsson 2002-10-25

Assigns past and future changes to FSF (cipher/{md4,crc}.c, CTR mode,  
CTS/MAC flags, self test improvements)  
simon@josefsson.org

LIBGCRYPT Moritz Schulte 2003-04-17

Assigns past and future changes.  
moritz@g10code.com

GNUTLS Nikolaos Mavrogiannopoulos 2003-11-22

nmav@gnutls.org  
Original code for cipher/rfc2268.c.

LIBGCRYPT The Written Word 2005-04-15

Assigns past and future changes. (new: src/libcrypt.pc.in,  
src/Makefile.am, src/secmem.c, mpi/hppa1.1/mpih-mul3.S,  
mpi/hppa1.1/udiv-qrnd.S, mpi/hppa1.1/mpih-mul2.S,  
mpi/hppa1.1/mpih-mul1.S, mpi/Makefile.am, tests/prime.c,  
tests/register.c, tests/ac.c, tests/basic.c, tests/tsexp.c,  
tests/keygen.c, tests/pubkey.c, configure.ac, acinclude.m4)

LIBGCRYPT Brad Hards 2006-02-09

Assigns Past and Future Changes  
bradh@frogmouth.net  
(Added OFB mode. Changed cipher/cipher.c, test/basic.c doc/gcrypt.tex.  
added SHA-224, changed cipher/sha256.c, added HMAC tests.)

LIBGCRYPT Hye-Shik Chang 2006-09-07

Assigns Past and Future Changes  
perky@freebsd.org  
(SEED cipher)

LIBGCRYPT Werner Dittmann 2009-05-20

Assigns Past and Future Changes  
werner.dittmann@t-online.de  
(mpi/amd64, tests/mpitests.c)

GNUPG David Shaw

Assigns past and future changes.  
dshaw@jabberwocky.com  
(cipher/camellia-glue.c and related stuff)

LIBGCRYPT Andrey Jivsov 2010-12-09

Assigns Past and Future Changes

openpgp@brainhub.org

(cipher/ecc.c and related files)

LIBGCRYPT Ulrich Mller 2012-02-15

Assigns Past and Future Changes

ulm@gentoo.org

(Changes to cipher/idea.c and related files)

LIBGCRYPT Vladimir Serbinenko 2012-04-26

Assigns Past and Future Changes

phcoder@gmail.com

(cipher/serpent.c)

Authors with a DCO

=====

Andrei Scherer <andsch@inbox.com>

2014-08-22:BF7CEF794F9.000003F0andsch@inbox.com:

Christian Aistleitner <christian@quelltextlich.at>

2013-02-26:20130226110144.GA12678@quelltextlich.at:

Christian Grothoff <christian@grothoff.org>

2013-03-21:514B5D8A.6040705@grothoff.org:

Dmitry Eremin-Solenikov <dbaryshkov@gmail.com>

2013-07-13:20130713144407.GA27334@fangorn.rup.mentorg.com:

Dmitry Kasatkin <dmitry.kasatkin@intel.com>

2012-12-14:50CAE2DB.80302@intel.com:

Jrmie Courrges-Anglas <jca@wxcvbn.org>

2016-05-26:87bn3ssqg0.fsf@ritchie.wxcvbn.org

Jussi Kivilinna <jussi.kivilinna@mbnet.fi>

2012-11-15:20121115172331.150537dzb5i6jmy8@www.dalek.fi:

Jussi Kivilinna <jussi.kivilinna@iki.fi>

2013-05-06:5186720A.4090101@iki.fi:

Markus Teich <markus dot teich at stusta dot mhn dot de>

2014-10-08:20141008180509.GA2770@trolle:

Mathias L. Baumann <mathias.baumann at sociomantic.com>

2017-01-30:07c06d79-0828-b564-d604-fd16c7c86ebe@sociomantic.com:



Milan Broz <gmazyland@gmail.com>  
2014-01-13:52D44CC6.4050707@gmail.com:

Peter Wu <peter@lekensteyn.nl>  
2015-07-22:20150722191325.GA8113@al:

Rafal Carr <funman@videolan.org>  
2012-04-20:4F91988B.1080502@videolan.org:

Sergey V. <sftp.mtuci@gmail.com>  
2013-11-07:2066221.51Ya7Yq760@darkstar:

Stephan Mueller <smueller@chronox.de>  
2014-08-22:2008899.25OeolVVA@myon.chronox.de:

Tom Mrz <tm@t8m.info>  
2012-04-16:1334571250.5056.52.camel@vespa.frost.loc:

Vitezslav Cizek <vcizek@suse.com>  
2015-11-05:20151105131424.GA32700@kolac.suse.cz

Werner Koch <wk@gnupg.org> (g10 Code GmbH)  
2012-12-05:87obi8u4h2.fsf@vigenere.g10code.de:

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Libgcrypt used to be part of GnuPG but has been taken out into its own package on 2000-12-21.

Most of the stuff in mpi has been taken from an old GMP library version by Torbjorn Granlund <tege@noisy.tmg.se>.

The files cipher/rndunix.c and cipher/rndw32.c are based on those files from Cryptlib. Copyright Peter Gutmann, Paul Kendall, and Chris Wedgwood 1996-1999.

The ECC code cipher/ecc.c was based on code by Sergi Blanch i Torne, sergi at calcurco dot org.

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# 1.469 ehcache-xml 3.8.1

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- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/BaseConfigParser.java
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- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/ServiceConfigurationParser.java
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- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/ResourceConfigurationParser.java
- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CacheServiceConfigurationParser.java
- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CoreCacheConfigurationParser.java
- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CacheManagerServiceConfigurationParser.java
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- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCacheEventListenerConfigurationParser.java
- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/SizeOfEngineLimits.java
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- \* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-

jar/org/ehcache/xml/service/DefaultSerializerConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/service/SimpleCoreServiceConfigurationParser.java  
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jar/org/ehcache/xml/provider/DefaultCopyProviderConfigurationParser.java  
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jar/org/ehcache/xml/XmlConfiguration.java  
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jar/org/ehcache/xml/service/DefaultCacheLoaderWriterConfigurationParser.java  
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jar/org/ehcache/xml/model/CacheTemplate.java  
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jar/org/ehcache/xml/provider/DefaultSerializationProviderConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/service/DefaultResilienceStrategyConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/service/DefaultSizeOfEngineConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/provider/SimpleCoreServiceCreationConfigurationParser.java  
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jar/org/ehcache/xml/service/DefaultWriteBehindConfigurationParser.java  
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jar/org/ehcache/xml/provider/CacheManagerPersistenceConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/CacheResourceConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/model/CacheDefinition.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/provider/OffHeapDiskStoreProviderConfigurationParser.java  
\* /opt/cola/permits/1258059276\_1643027393.71/0/ehcache-xml-3-8-1-sources-  
jar/org/ehcache/xml/model/CacheSpec.java

## 1.470 jquery 3.5.1

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# 1.471 gmp 6.2.0

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jar/javassist/tools/rmi/StubGenerator.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/ast/BinExpr.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/compiler/SymbolTable.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/BadBytecode.java
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jar/javassist/tools/web/Webserver.java
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* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/convert/TransformBefore.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/Proxy.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/analysis/SubroutineScanner.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-
jar/javassist/bytecode/InstructionPrinter.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/Callback.java
* /opt/cola/permits/1135880377_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/runtime/Inner.java
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\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/CtNewWrappedConstructor.java  
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\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ByteArray.java  
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\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/tools/framedump.java  
\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/CallExpr.java  
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\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/TypeData.java  
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\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/FloatMemberValue.java  
\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/EnumMemberValue.java  
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\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/ArrayMemberValue.java  
\* /opt/cola/permits/1135880377\_1613624050.66/0/javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/LongMemberValue.java

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jar/org/springframework/expression/spel/ast/OpPlus.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OperatorMatches.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-

jar/org/springframework/expression/spel/ast/InlineList.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/InlineMap.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/NullLiteral.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpOr.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpMultiply.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/Operator.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpLT.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/VariableReference.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/TypeCode.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpEQ.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/BooleanLiteral.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/PropertyOrFieldReference.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpGT.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/Literal.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OperatorPower.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/FloatLiteral.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpGE.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OperatorInstanceof.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/StringLiteral.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/standard/InternalSpelExpressionParser.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpDivide.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/Selection.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/OpNE.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/support/ReflectiveConstructorResolver.java  
\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-

jar/org/springframework/expression/spel/ast/OpMinus.java

\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-

jar/org/springframework/expression/spel/ast/IntLiteral.java

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jar/org/springframework/expression/spel/support/ReflectivePropertyAccessor.java

\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-

jar/org/springframework/expression/spel/standard/SpelCompiler.java

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jar/org/springframework/expression/spel/ast/MethodReference.java

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\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ConstructorResolver.java

\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/TypeLocator.java

\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/TokenKind.java

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jar/org/springframework/expression/TypeComparator.java

\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/spel/ast/BeanReference.java

\* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-  
jar/org/springframework/expression/BeanResolver.java

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  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/CompiledExpression.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelParseException.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ParserContext.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/support/StandardTypeLocator.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/AccessException.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/TypeConverter.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/common/ExpressionUtils.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/Token.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ParseException.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/OperatorOverloader.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelParserConfiguration.java
  - \* /opt/cola/permits/1301486335\_1649248826.65/0/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/support/ReflectiveConstructorExecutor.java
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* /opt/cola/permits/1301486335_1649248826.65/0/spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/SpelCompilerMode.java
* /opt/cola/permits/1301486335_1649248826.65/0/spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/standard/SpelExpressionParser.java
* /opt/cola/permits/1301486335_1649248826.65/0/spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/CompilablePropertyAccessor.java
```

## 1.474 junixsocket-native-common 2.3.2

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```
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 * junixsocket
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 */
```

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```
* /opt/ws_local/PERMITS_SQL/1046144837_1589880123.03/0/junixsocket-native-common-2-3-2-sources-
jar/org/newsclub/lib/junixsocket/common/NarMetadata.java
```

## 1.475 libpcap 1.2.1

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## 1.476 libbsd 0.10.0 1

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include/bsd/sys/time.h

include/bsd/timeconv.h

include/bsd/vis.h

man/bitstring.3bsd

man/errc.3bsd

man/explicit\_bzero.3bsd

man/fgetln.3bsd

man/fgetwln.3bsd

man/fpurge.3bsd

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man/nlist.3bsd

man/queue.3bsd

man/radixsort.3bsd

man/reallocarray.3bsd

man/reallocf.3bsd

man/setmode.3bsd

man/strmode.3bsd

man/strnstr.3bsd

man/strtoi.3bsd

man/strtou.3bsd

man/unvis.3bsd

man/vis.3bsd

man/wcsncpy.3bsd

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src/heapsort.c

src/merge.c

src/nlist.c

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src/flopen.c

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man/fparseln.3bsd

src/fparseln.c

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man/readpassphrase.3bsd

man/strncpy.3bsd

man/strtonum.3bsd

src/arc4random.c

src/arc4random\_linux.h

src/arc4random\_openbsd.h

src/arc4random\_uniform.c

src/arc4random\_unix.h

src/arc4random\_win.h

src/closefrom.c  
src/getentropy\_aix.c  
src/getentropy\_bsd.c  
src/getentropy\_hpux.c  
src/getentropy\_hurd.c  
src/getentropy\_linux.c  
src/getentropy\_osx.c  
src/getentropy\_solaris.c  
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src/hash/md5.c

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## 1.477 syslinux 4.07

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