

Explore and have fun with TensorFlow



An introductory to TensorFlow

Poo Kuan Hoong

<https://www.facebook.com/groups/TensorFlowMY/>



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Agenda

- Deep Learning Libraries
- What is TensorFlow?
- Why it is called TensorFlow?
- Steps to start TensorFlow
- TensorFlow Graph
- Variables & Placeholders
- Gradient
- TensorFlow Architecture
- Demo



About me



Poo Kuan Hoong, <http://www.linkedin.com/in/kuanhoong>



- Senior Data Scientist



- Senior Manager Data Science



- Senior Lecturer
- Chairperson Data Science Institute



- Founder R User Group & TensorFlow User Group
- Speaker/Trainer



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Github: <https://github.com/TensorFlowMY>

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TensorFlow & Deep Learning Malaysia Group

The TensorFlow & Deep Learning Malaysia group's aims are:

- To enable people to create and deploy their own Deep Learning models built using primarily TensorFlow or other Deep Learning libraries.
- To build the key skill sets for this group from the combination of both beginner and intermediate models as well as advancing to the next level
- A knowledge sharing and presentations platform in relation to the cutting edge deep learning research papers and techniques.



Malaysia R User Group - (myRUG)

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Kuala Lumpur,
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Founded Jun 5, 2016

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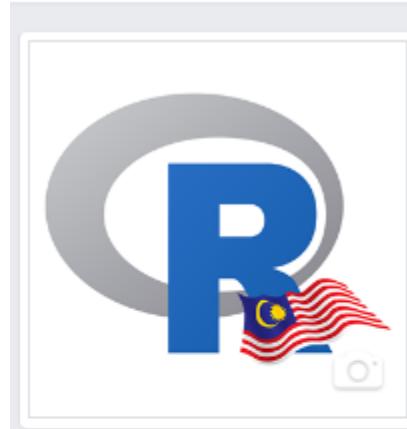
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R User Group Malaysia

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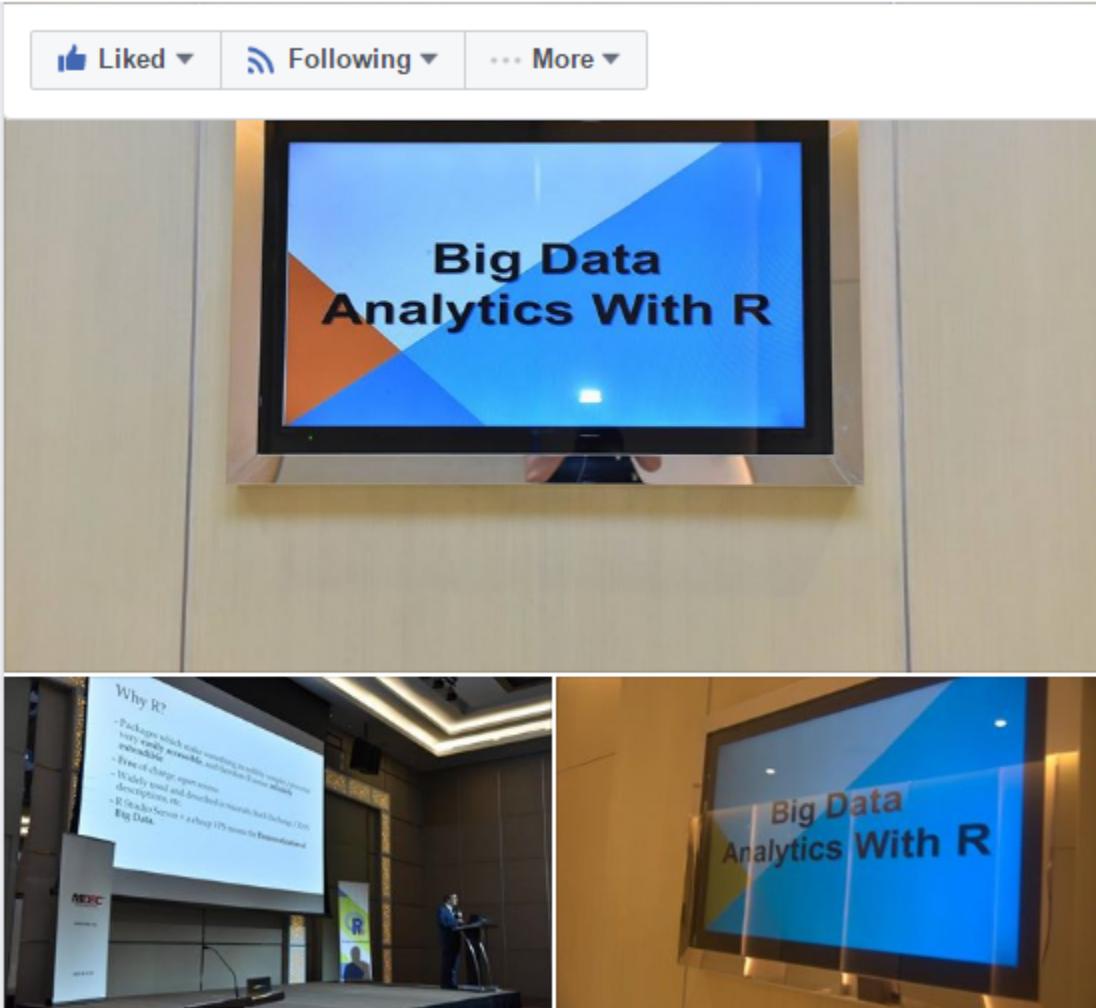
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The R User Group Malaysia is a diverse group that come together to discuss anything related to the R programming language.



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Deep learning libraries



theano



Caffe

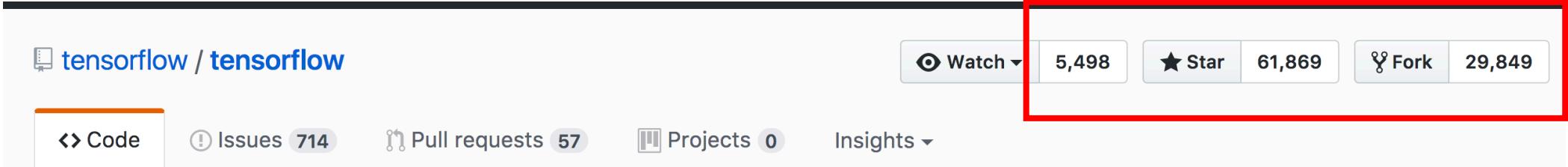


What is TensorFlow?

- URL: <https://www.tensorflow.org/>
- Released under the open source license on November 9, 2015
- Current version 1.2
- Open source software library for numerical computation using data flow graphs
- Originally developed by Google Brain Team to conduct machine learning and deep neural networks research
- General enough to be applicable in a wide variety of other domains as well
- TensorFlow provides an extensive suite of functions and classes that allow users to build various models from scratch.



Most popular on Github



tensorflow / tensorflow

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Code Issues 714 Pull requests 57 Projects 0 Insights

Computation using data flow graphs for scalable machine learning <http://tensorflow.org>

tensorflow machine-learning python deep-learning deep-neural-networks neural-network ml distributed

19,049 commits 16 branches 33 releases 917 contributors Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

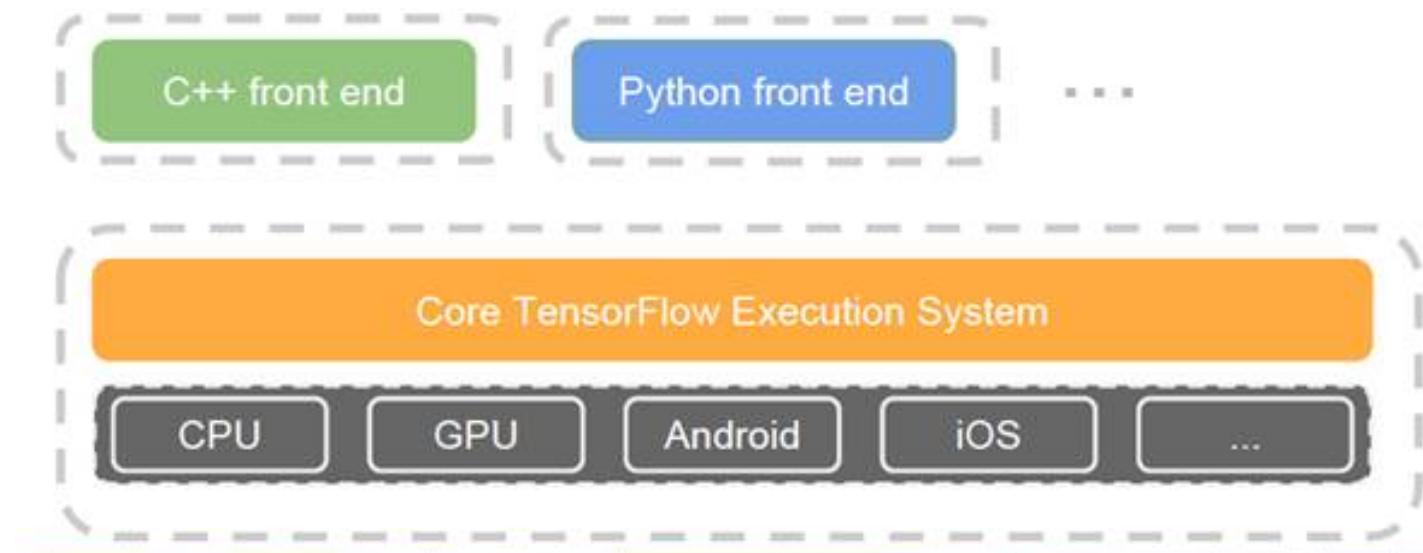
 AnishShah committed with drpngx [issue #10835] Negative axis support for gradient of reduce_prod (#11019) ... Latest commit ea79ba4 3 hours ago
 tensorflow [issue #10835] Negative axis support for gradient of reduce_prod (#11019) 3 hours ago
 third_party Add python import library on Windows (#10980) a day ago
 tools Create tf_env_collect.sh 13 days ago

<https://github.com/tensorflow/tensorflow>



TensorFlow architecture

- Core in C++
 - Low overhead
- Different front ends for specifying/driving the computation
 - Python, C++, R and many more



CPU - GPU

- In TensorFlow, the supported device types are CPU and GPU. They are represented as strings. For example:

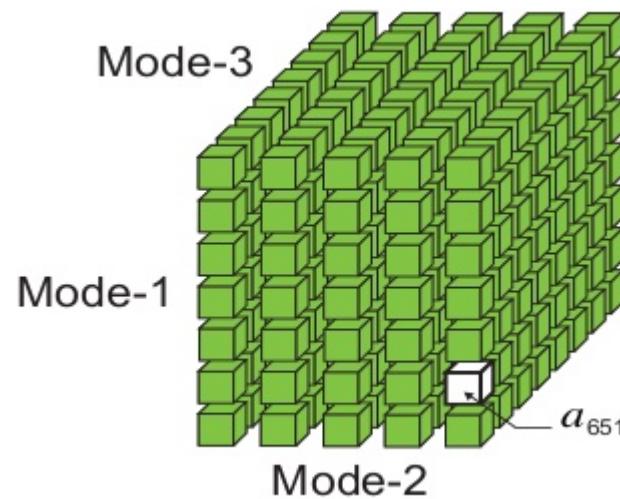
- "/cpu:0" : The CPU of your machine.
- "/gpu:0" : The GPU of your machine, if you have one.
- "/gpu:1" : The second GPU of your machine, etc.

```
# Creates a graph.
with tf.device('/gpu:2'):
    a = tf.constant([1.0, 2.0, 3.0, 4.0, 5.0, 6.0], shape=[2, 3], name='a')
    b = tf.constant([1.0, 2.0, 3.0, 4.0, 5.0, 6.0], shape=[3, 2], name='b')
    c = tf.matmul(a, b)
# Creates a session with log_device_placement set to True.
sess = tf.Session(config=tf.ConfigProto(log_device_placement=True))
# Runs the op.
print(sess.run(c))
```



Why it is called TensorFlow?

- What is a Tensor?

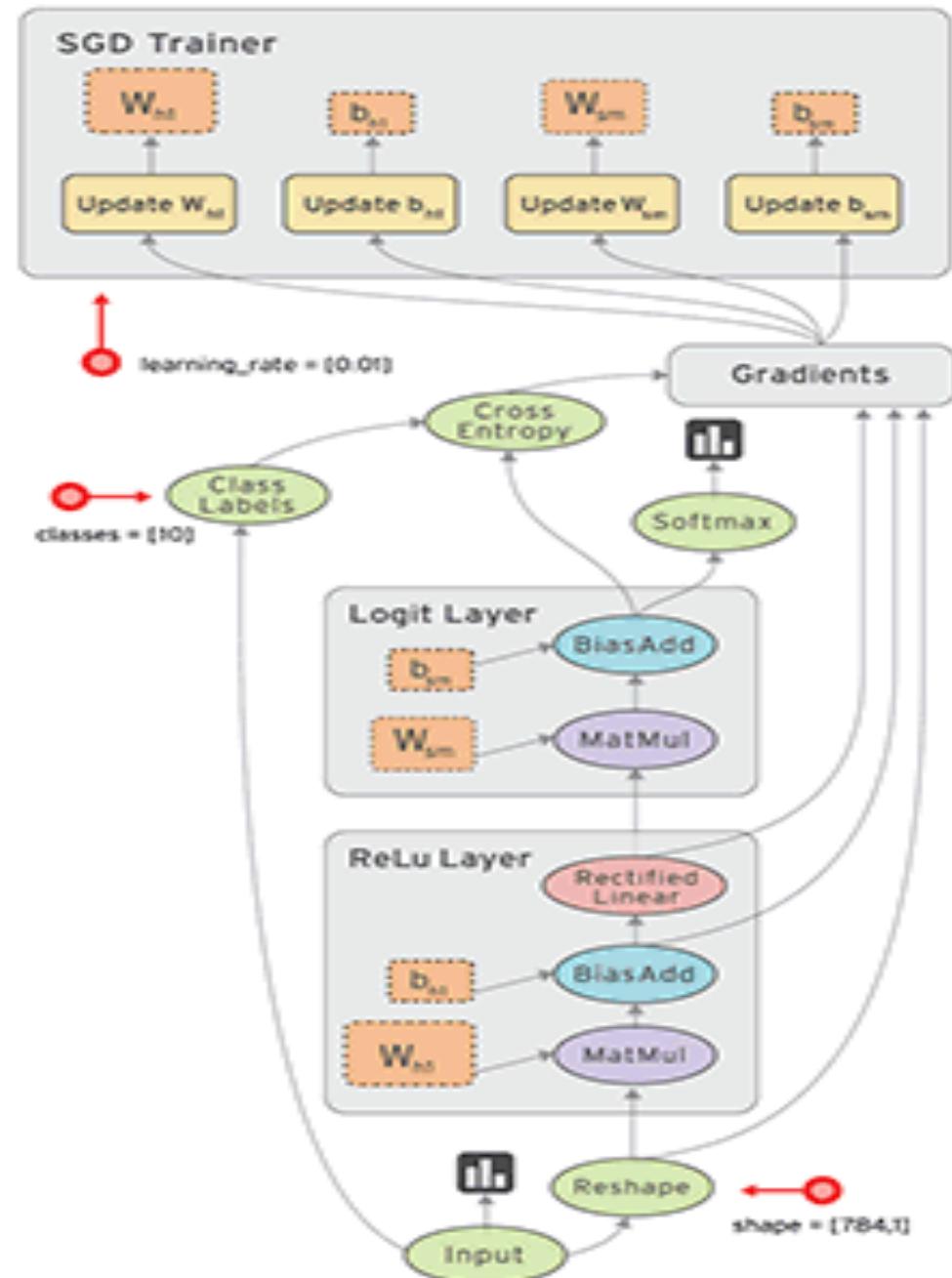


Dimensions	Example	Terminology									
1	<table border="1"><tr><td>0</td><td>1</td><td>2</td></tr></table>	0	1	2	Vector						
0	1	2									
2	<table border="1"><tr><td>0</td><td>1</td><td>2</td></tr><tr><td>3</td><td>4</td><td>5</td></tr><tr><td>6</td><td>7</td><td>8</td></tr></table>	0	1	2	3	4	5	6	7	8	Matrix
0	1	2									
3	4	5									
6	7	8									
3	<table border="1"><tr><td>0</td><td>1</td><td>2</td></tr><tr><td>3</td><td>4</td><td>5</td></tr><tr><td>6</td><td>7</td><td>8</td></tr></table>	0	1	2	3	4	5	6	7	8	3D Array (3 rd order Tensor)
0	1	2									
3	4	5									
6	7	8									
N	<table border="1"><tr><td>0 1 2</td><td>...</td><td>0 1 2</td></tr><tr><td>3 4 5</td><td>...</td><td>3 4 5</td></tr><tr><td>6 7 8</td><td>...</td><td>6 7 8</td></tr></table>	0 1 2	...	0 1 2	3 4 5	...	3 4 5	6 7 8	...	6 7 8	ND Array
0 1 2	...	0 1 2									
3 4 5	...	3 4 5									
6 7 8	...	6 7 8									



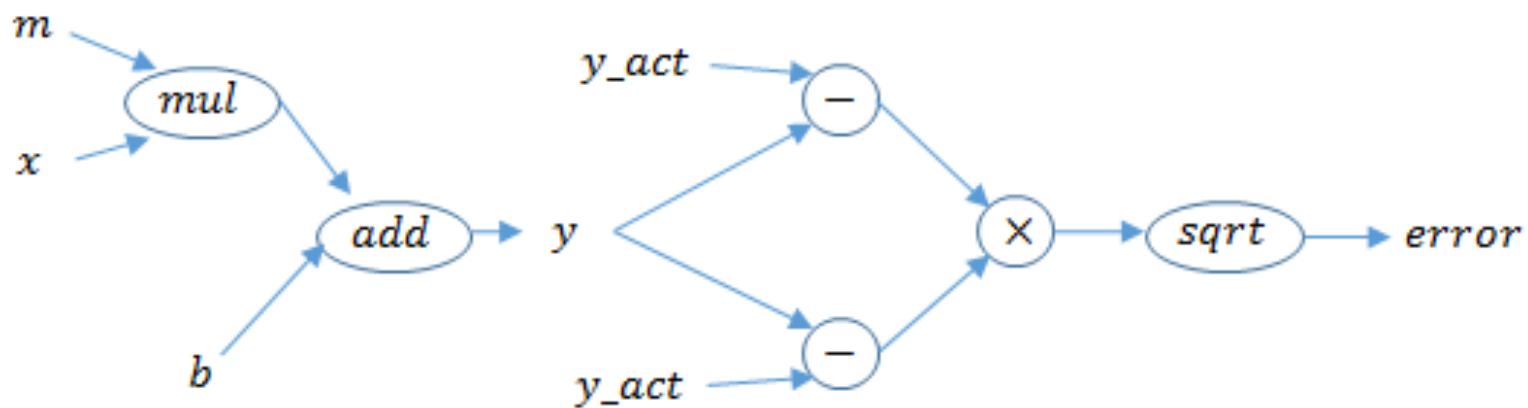
Why it is called TensorFlow?

- TensorFlow is based on computation data flow graph
- TensorFlow separates definition of computations from their execution



Steps to start with TensorFlow

- **Step 1:** Assemble a computational graph
- **Step 2:** Use a session to execute operations in the graph



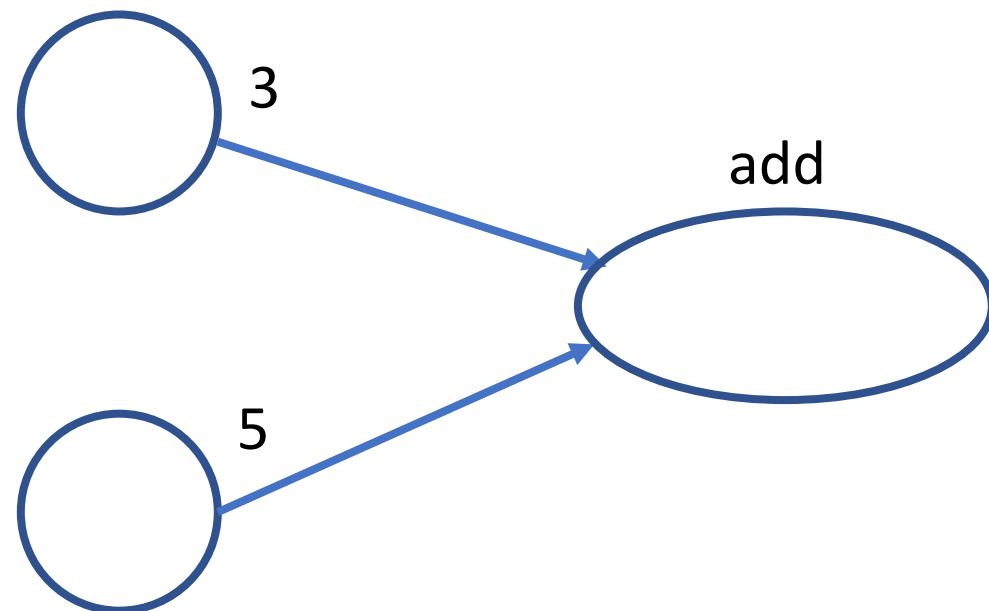
TensorFlow Graph

```
import tensorflow as tf  
a = tf.add(3,5)  
print(a)
```

Tensor("Add:0", shape=(), dtype=int32)

```
import numpy as np  
a = np.add(3,5)  
print(a)
```

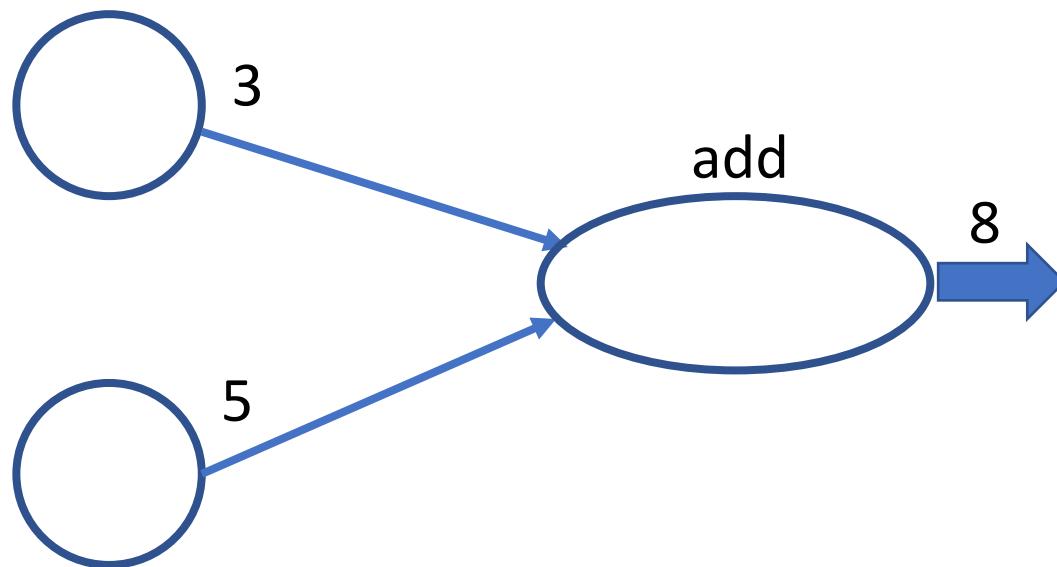
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TensorFlow Graph

- To get the value of a
- Create a **session**, assign it to variable ‘sess’ so we can call it later
- Within the session, evaluate the graph to fetch the value of *a*

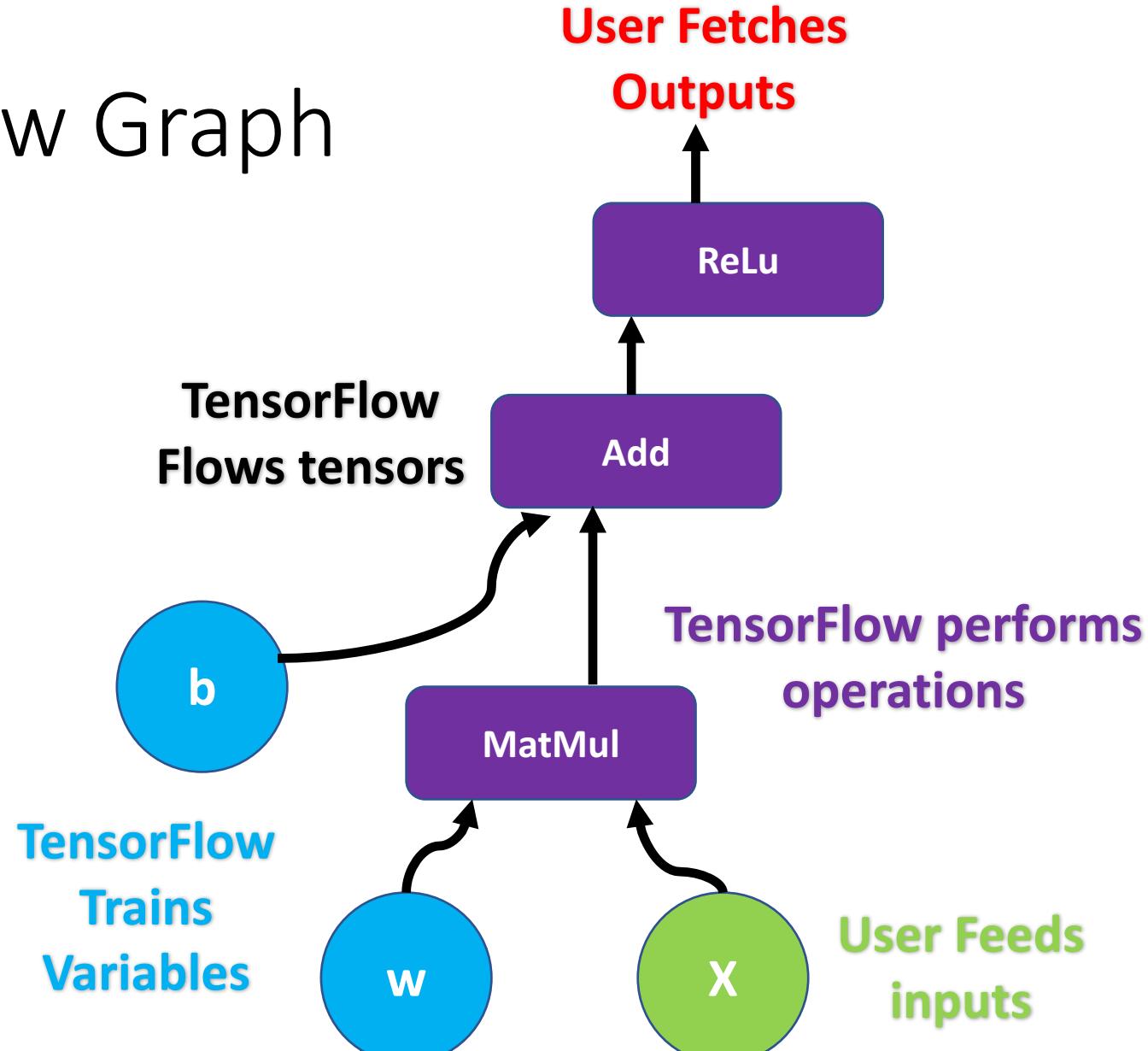
```
import tensorflow as tf  
a = tf.add(3, 5)  
sess = tf.Session()  
print (sess.run(a))  
sess.close()
```



- A Session object encapsulates the environment in which Operation objects are executed, and Tensor objects are evaluated.



TensorFlow Graph



Variables

- Variables to hold and update parameters.
- Variables are in-memory buffers containing tensors.
- Must be explicitly initialized and can be saved to disk during and after training

```
# create variable a with scalar value
a = tf.Variable(2, name="scalar")

# create variable b as a vector
b = tf.Variable([2, 3], name="vector")

# create variable c as a 2x2 matrix
c = tf.Variable([[0, 1], [2, 3]], name="matrix")

init = tf.global_variables_initializer()
with tf.Session() as sess:
    sess.run(init)
```



Placeholder

- A placeholder is simply a variable that will be assigned data to at a later date.
- It allows operations to be created and computation graph to be built, without needing the data.

```
x = tf.placeholder("float", None)
y = x * 2

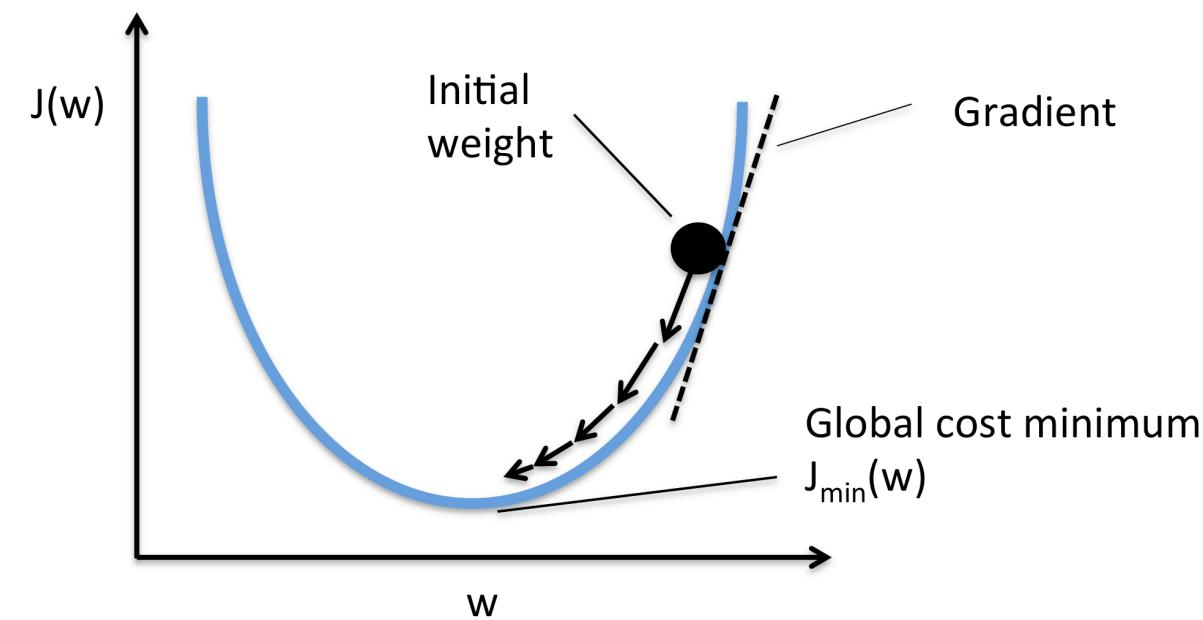
with tf.Session() as session:
    result = session.run(y, feed_dict={x: [1, 2, 3]})
print(result)
```

```
[ 2.  4.  6.]
```

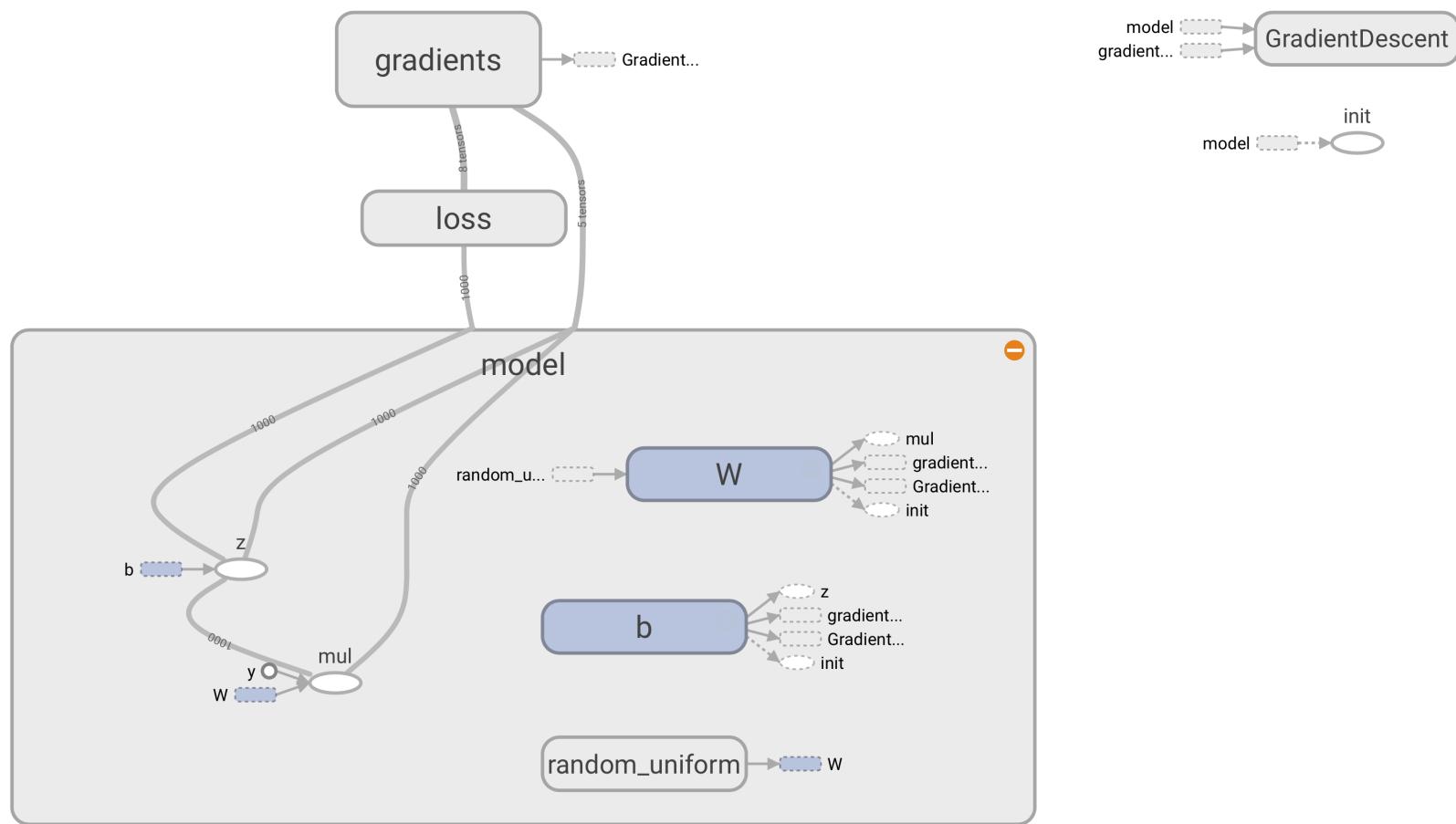


Learn Parameters: Optimization

- The Optimizer base class provides methods to compute gradients for a loss and apply gradients to variables.
- A collection of subclasses implement classic optimization algorithms such as GradientDescent and Adagrad.
- TensorFlow provides functions to compute the derivatives for a given TensorFlow computation graph, adding operations to the graph.

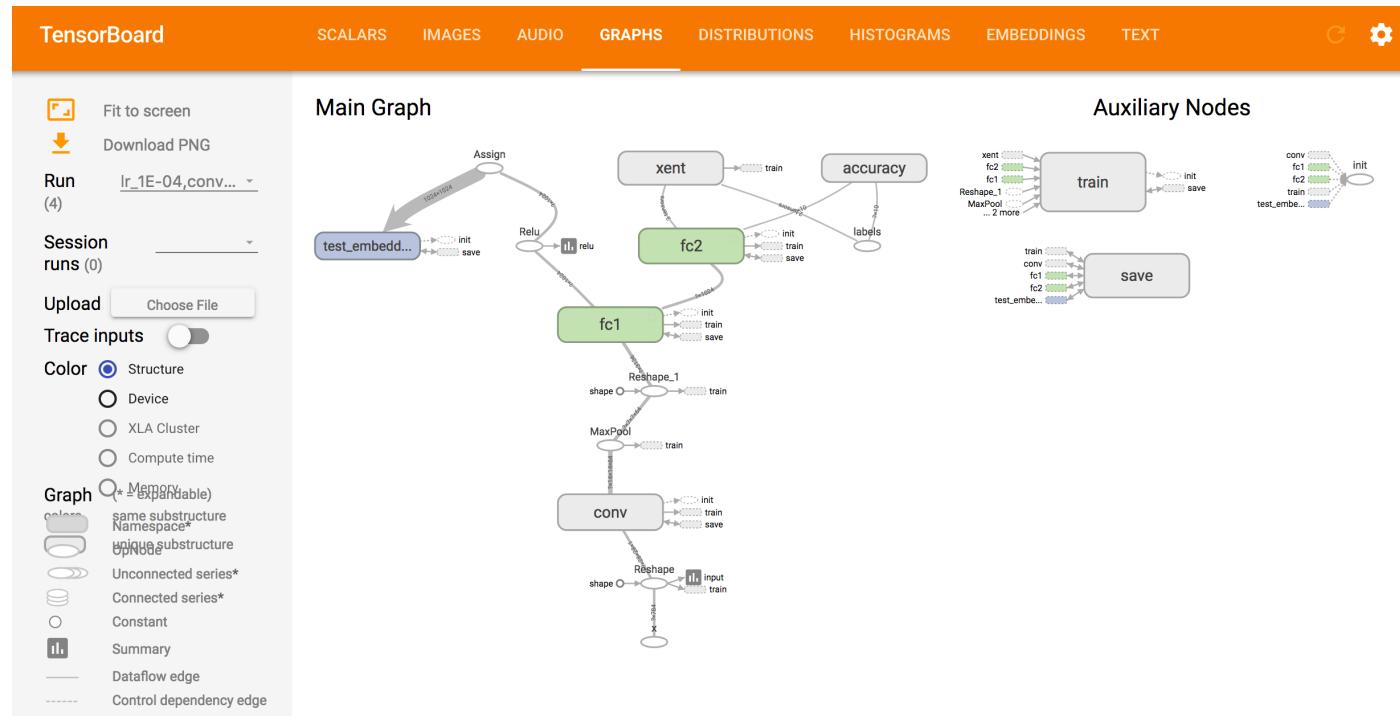


Learn parameters: Optimization



TensorBoard

- Visualize your TensorFlow graph
- Plot quantitative metrics about the execution of your graph
- Show additional data like images that pass through it



TensorFlow Models

<https://github.com/tensorflow/models>

Models

- [adversarial crypto](#): protecting communications with adversarial neural cryptography.
- [adversarial text](#): semi-supervised sequence learning with adversarial training.
- [attention ocr](#): a model for real-world image text extraction.
- [autoencoder](#): various autoencoders.
- [cognitive mapping and planning](#): implementation of a spatial memory based mapping and planning architecture for visual navigation.
- [compression](#): compressing and decompressing images using a pre-trained Residual GRU network.
- [differential privacy](#): privacy-preserving student models from multiple teachers.
- [domain adaptation](#): domain separation networks.
- [im2txt](#): image-to-text neural network for image captioning.
- [inception](#): deep convolutional networks for computer vision.



Take away

- There are 4 steps:
 - Step 1: Assemble the graph –
 - 1. Define placeholders for input and output
 - 2. Define the weights
 - 3. Define the inference model
 - 4. Define loss function
 - 5. Define optimizer
 - Step 2: Train the Model
 - Step 3: Optimize the Model



Demo

Slides & Codes available from Github: <http://bit.ly/TensorFlowMY>



Thanks!

Questions?



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