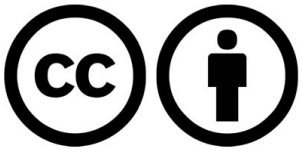
With TF 1.0!

Lab 1

TensorFlow Basics

Sung Kim <hunkim+ml@gmail.com>

Code: https://github.com/hunkim/DeepLearningZeroToAll/



Call for comments

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Other slides: https://goo.gl/jPtWNt

Picture from http://www.tssablog.org/archives/3280

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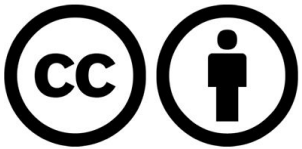

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An open-source software library for Machine Intelligence

GET STARTED

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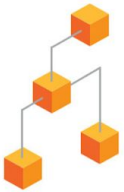
UPGRADE NOW



Dynamic graphs in TensorFlow

We've open-sourced TensorFlow Fold to make it easier than ever to work with input data with varying shapes and sizes.

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The 2017 TensorFlow Dev Summit

Thousands of people from the TensorFlow community participated in the first flagship event. Watch the keynote and talks.

WATCH VIDEOS

https://www.tensorflow.org

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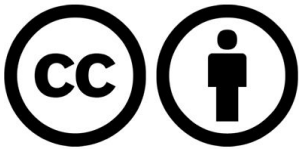

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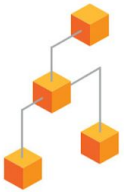

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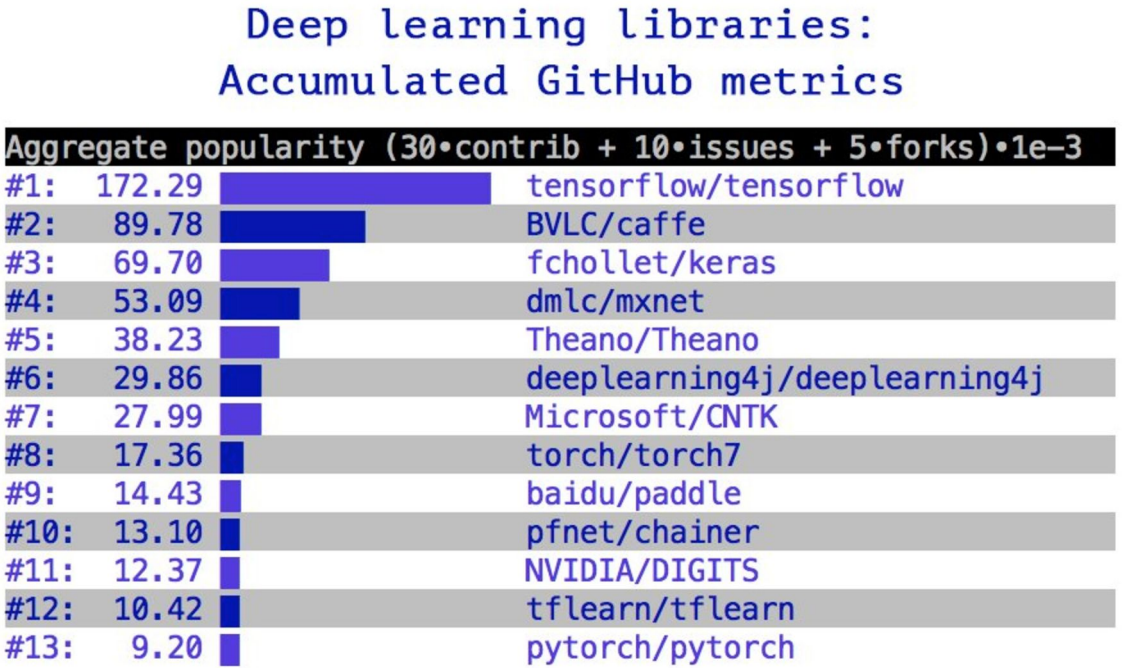
TensorFlow



https://twitter.com/fchollet/status/830499993450450944/

Deep learning libraries: growth over past three months

new contributors from 2016-10-09 to 2017-02-10		
#1:	192	tensorflow/tensorflow
#2:	89	dmlc/mxnet
#3:	78	fchollet/keras
#4:	42	baidu/paddle
#5:	29	Microsoft/CNTK
#6:	23	pfnet/chainer
#7:	21	Theano/Theano
#8:	20	deeplearning4j/deeplearning4j
#9:	20	tflearn/tflearn
#10:	19	BVLC/caffe
#11:	9	torch/torch7
#12:	3	NVIDIA/DIGITS

new forks from 2016-10-09 to 2017-02-10		
#1:	6525	tensorflow/tensorflow
#2:	1822	BVLC/caffe
#3:	1316	fchollet/keras
#4:	999	dmlc/mxnet
#5:	909	deeplearning4j/deeplearning4j
#6:	887	Microsoft/CNTK
#7:	324	tflearn/tflearn
#8:	321	baidu/paddle
#9:	287	Theano/Theano
#10:	257	torch/torch7
#11:	175	NVIDIA/DIGITS
#12:	142	pfnet/chainer

new issues from 2016-10-09 to 2017-02-10		
#1:	1563	tensorflow/tensorflow
#2:	979	fchollet/keras
#3:	871	dmlc/mxnet
#4:	646	baidu/paddle
#5:	486	Microsoft/CNTK
#6:	361	deeplearning4j/deeplearning4j
#7:	318	BVLC/caffe
#8:	217	NVIDIA/DIGITS
#9:	214	Theano/Theano
#10:	167	tflearn/tflearn
#11:	150	pfnet/chainer
#12:	90	torch/torch7

aggregate metrics growth from 2016-10-09 to 2017-02-10		
#1:	54.01	tensorflow/tensorflow
#2:	18.71	fchollet/keras
#3:	16.38	dmlc/mxnet
#4:	12.86	BVLC/caffe
#5:	10.17	Microsoft/CNTK
#6:	9.32	baidu/paddle
#7:	8.75	deeplearning4j/deeplearning4j
#8:	4.21	Theano/Theano
#9:	3.89	tflearn/tflearn
#10:	3.14	NVIDIA/DIGITS
#11:	2.90	pfnet/chainer
#12:	2.46	torch/torch7

François Chollet @fchollet · Feb 11

Time for an update: what does the deep learning library landscape look like, seen from GitHub? pic.twitter.com/QDZyvLrYBd

https://twitter.com/fchollet/status/830499993450450944/

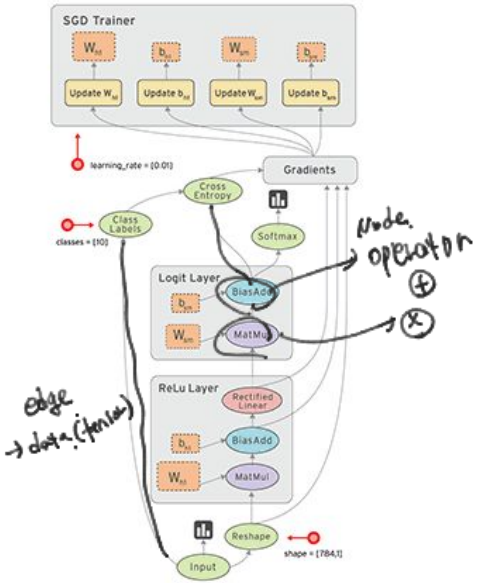
TensorFlow

- TensorFlow™ is an open source software library for numerical computation using data flow graphs.
- Python!

https://www.tensorflow.org/

What is a Data Flow Graph?

- Nodes in the graph represent mathematical operations
- Edges represent the multidimensional data arrays (tensors) communicated between them.



https://www.tensorflow.org/

Installing TensorFlow

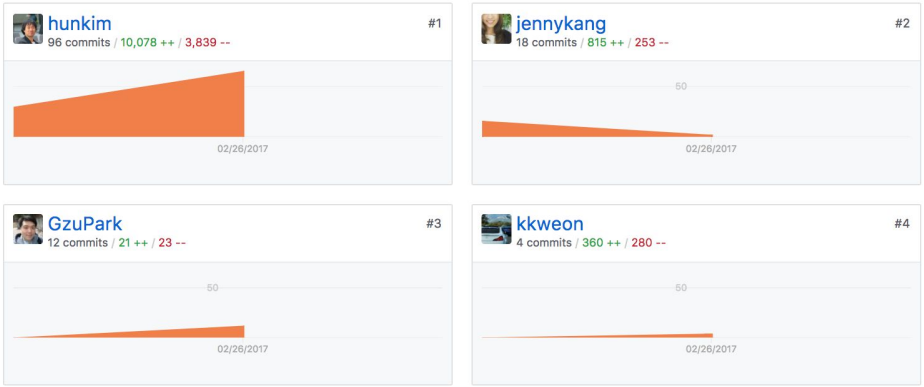
- Linux, Max OSX, Windows
  - (sudo -H) pip install --upgrade tensorflow
  - (sudo -H) pip install --upgrade tensorflow-gpu
- From source
  - bazel ...
  - https://www.tensorflow.org/install/install_sources
- Google search/Community help
  - https://www.facebook.com/groups/TensorFlowKR/

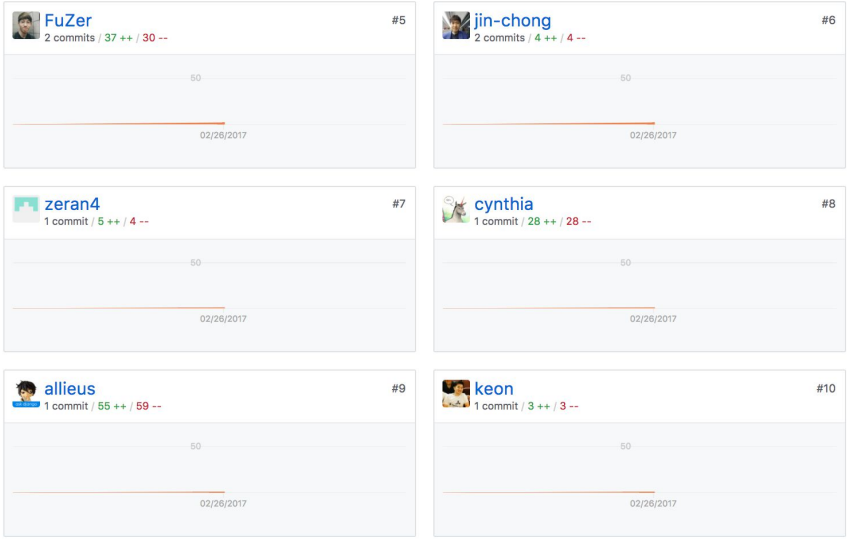
https://www.tensorflow.org/install/

Check installation and version

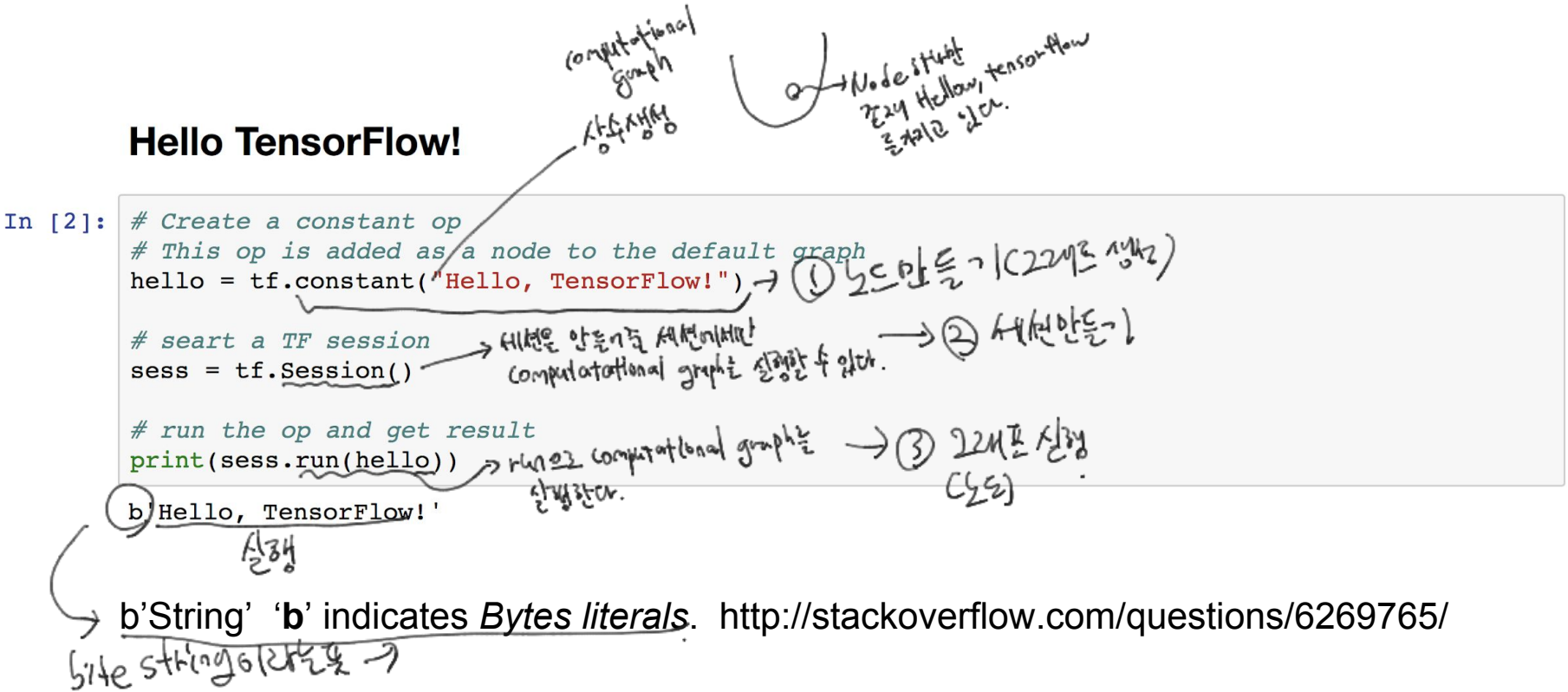
```
Sungs-MacBook-Pro:hunkim$ python3
Python 3.6.0 (v3.6.0:41df79263a11, Dec 22 2016, 17:23:13)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for more
information.
>>> import tensorflow as tf
>>> tf.__version__
'1.0.0'
>>>
```

https://github.com/hunkim/DeepLearningZeroToAll/



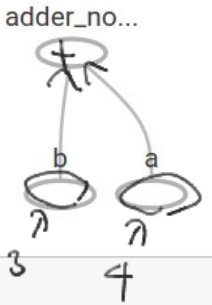


TensorFlow Hello World!



https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-01-basics.ipynb

Computational Graph



a, b 노드가 +3 연결되었다.

data type을 줄수있음

float이 default

node3 = node1 + node2 로도 표현가능

```
In [4]: node1 = tf.constant(3.0, tf.float32)
        node2 = tf.constant(4.0) # also tf.float32 implicitly
        node3 = tf.add(node1, node2)
```

```
In [5]: print("node1:", node1, "node2:", node2)
        print("node3: ", node3)
```

2개 출력

```
node1: Tensor("Const_1:0", shape=(), dtype=float32) node2: Tensor("Const_2:0", shape=(), dtyp
e=float32)
node3:  Tensor("Add:0", shape=(), dtype=float32)
```

```
In [6]: sess = tf.Session()
        print("sess.run(node1, node2): ", sess.run([node1, node2]))
        print("sess.run(node3): ", sess.run(node3))
```

session 노드를 실행

run( ) 안에는 실행시키고 싶은 노드

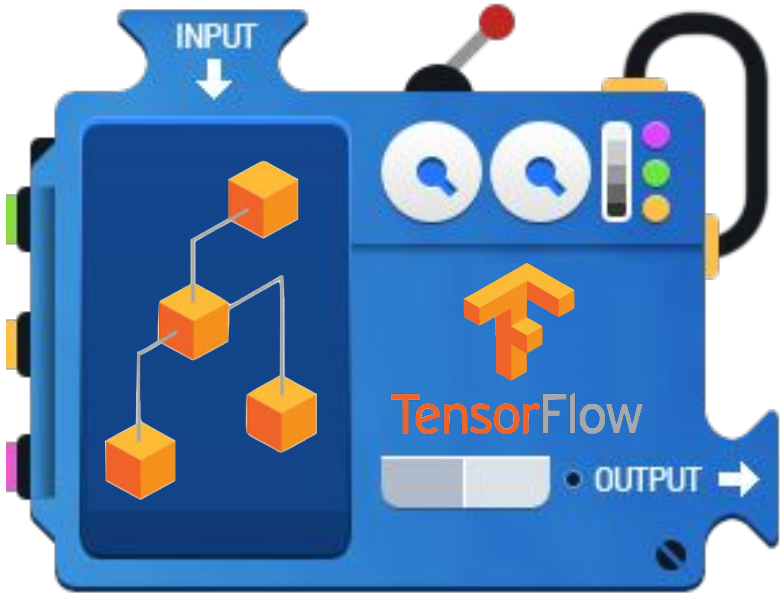
```
sess.run(node1, node2):  [3.0, 4.0]
sess.run(node3):  7.0
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-01-basics.ipynb

TensorFlow Mechanics

2 feed data and run graph (operation)
sess.run (op)

↳ graph를 실행



1 Build graph using
TensorFlow operations

↳ tensorflow tool로 graph를 일단 Build

2 결과로 graph 속의 값이 update 되게 새로운 값을 return 해줌

3 update variables
in the graph
(and return values)

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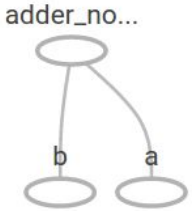
Computational Graph



(1) Build graph (tensors) using TensorFlow operations

```
In [4]: node1 = tf.constant(3.0, tf.float32)
        node2 = tf.constant(4.0) # also tf.float32 implicitly
        node3 = tf.add(node1, node2)
```

(2) feed data and run graph (operation)
sess.run (op)

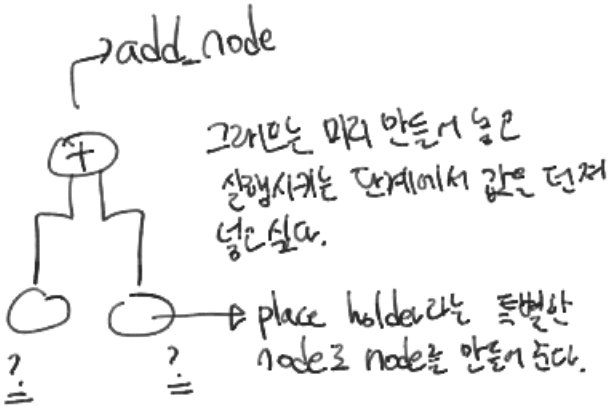
(3) update variables in the graph
(and return values)

```
In [6]: sess = tf.Session()
        print("sess.run(node1, node2): ", sess.run([node1, node2]))
        print("sess.run(node3): ", sess.run(node3))
```

```
sess.run(node1, node2):  [3.0, 4.0]
sess.run(node3):  7.0
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-01-basics.ipynb

Placeholder



placeholder에서 값은 넣어주게 하는것

type은 지정

placeholder의 값

adder Node는 실행

place holder는 통해 값을 넣어주게 함 (호출적)

array로 넣어줌

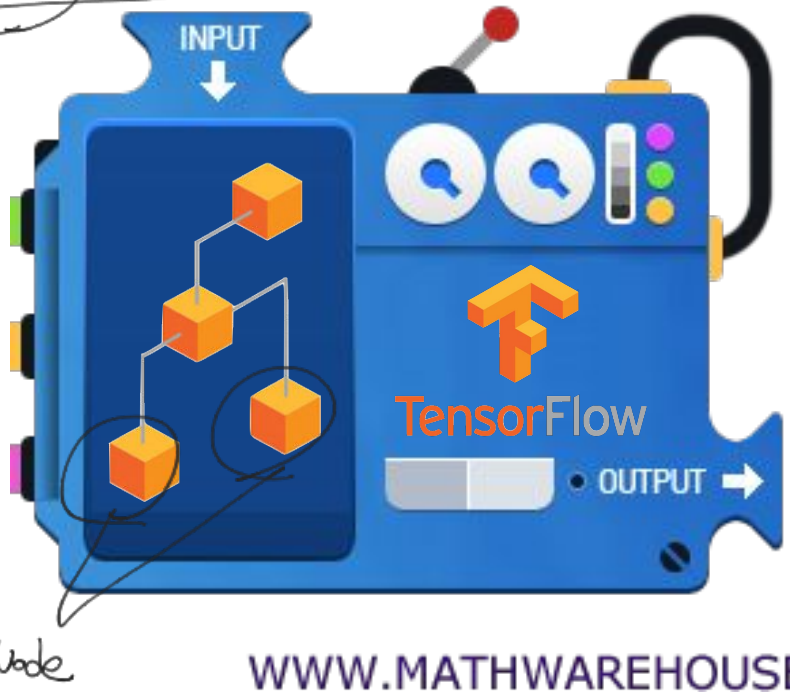
```
In [7]: a = tf.placeholder(tf.float32)
        b = tf.placeholder(tf.float32)
        adder_node = a + b  # + provides a shortcut for tf.add(a, b)

        print(sess.run(adder_node, feed_dict={a: 3, b: 4.5}))
        print(sess.run(adder_node, feed_dict={a: [1,3], b: [2, 4]}))
```

```
7.5
[ 3.  7.]
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-01-basics.ipynb

TensorFlow Mechanics

2 feed data and run graph (operation)
sess.run (op, feed_dict={x: x_data})



1 Build graph using TensorFlow operations

3 update variables in the graph (and return values)

Everything is **Tensor**

Tensors

In [3]:
```
3 # a rank 0 tensor; this is a scalar with shape []
[1. ,2., 3.] # a rank 1 tensor; this is a vector with shape [3]
[[1., 2., 3.], [4., 5., 6.]] # a rank 2 tensor; a matrix with shape [2, 3]
[[[1., 2., 3.]], [[7., 8., 9.]]] # a rank 3 tensor with shape [2, 1, 3]
```

Out[3]:
```
[[[1.0, 2.0, 3.0]], [[7.0, 8.0, 9.0]]]
```

```
t = tf.Constant([1., 2., 3.])
```

Tensor Ranks, Shapes, and Types

```
t = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
```

Rank	Math entity	Python example
0	Scalar (magnitude only)	`s = 483`
1	Vector (magnitude and direction)	`v = [1.1, 2.2, 3.3]`
2	Matrix (table of numbers)	`m = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]`
3	3-Tensor (cube of numbers)	`t = [[[2], [4], [6]], [[8], [10], [12]], [[14], [16], [18]]]`
n	n-Tensor (you get the idea)	`....`

https://www.tensorflow.org/programmers_guide/dims_types

Tensor Ranks, Shapes, and Types

```
t = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
```

Rank	Shape	Dimension number	Example
0	[]	0-D	A 0-D tensor. A scalar.
1	[D0]	1-D	A 1-D tensor with shape [5].
2	[D0, D1]	2-D	A 2-D tensor with shape [3, 4].
3	[D0, D1, D2]	3-D	A 3-D tensor with shape [1, 4, 3].
n	[D0, D1, ... Dn-1]	n-D	A tensor with shape [D0, D1, ... Dn-1].

https://www.tensorflow.org/programmers_guide/dims_types

Tensor Ranks, Shapes, and Types

```
t = [[1, 2, 3], [4, 5, 6], [7, 8, 9]]
```

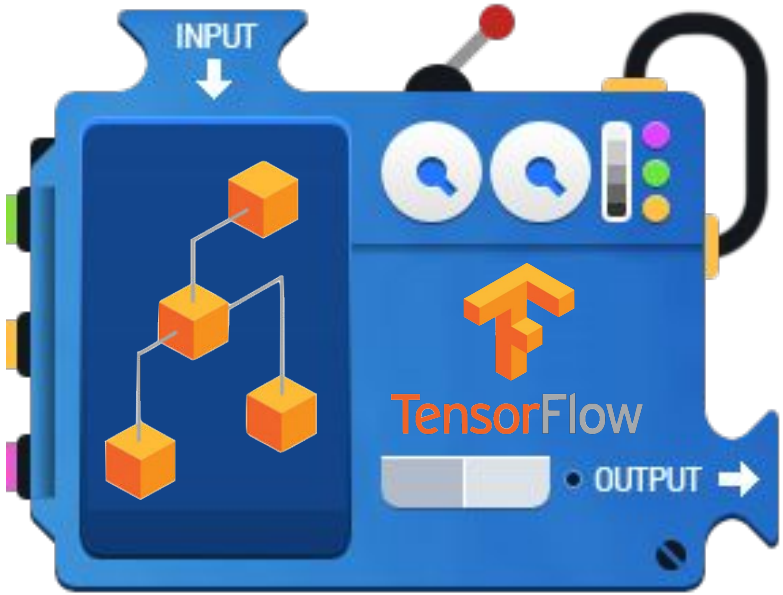
Data type	Python type	Description
DT_FLOAT	tf.float32	32 bits floating point.
DT_DOUBLE	tf.float64	64 bits floating point.
DT_INT8	tf.int8	8 bits signed integer.
DT_INT16	tf.int16	16 bits signed integer.
DT_INT32	tf.int32	32 bits signed integer.
DT_INT64	tf.int64	64 bits signed integer.

...

https://www.quora.com/When-should-I-use-tf-float32-vs-tf-float64-in-TensorFlow

TensorFlow Mechanics

2 feed data and run graph (operation)
sess.run (op, feed_dict={x: x_data})



1 Build graph using
TensorFlow operations

3 update variables
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(and return values)

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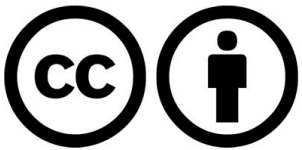
Lab 2

Linear Regression

Sung Kim <hunkim+ml@gmail.com>




1
2
3
4
5
6
7
8
9
10

Variables

```
# Create two variables.
weights = tf.Variable(tf.random_normal([784, 200], stddev=0.35),
                      name="weights")
biases = tf.Variable(tf.zeros([200]), name="biases")
...
# Add an op to initialize the variables.
init_op = tf.global_variables_initializer()

# Later, when launching the model
with tf.Session() as sess:
  # Run the init operation.
  sess.run(init_op)
  ...
  # Use the model
  ...
```

https://www.tensorflow.org/programmers_guide/variables