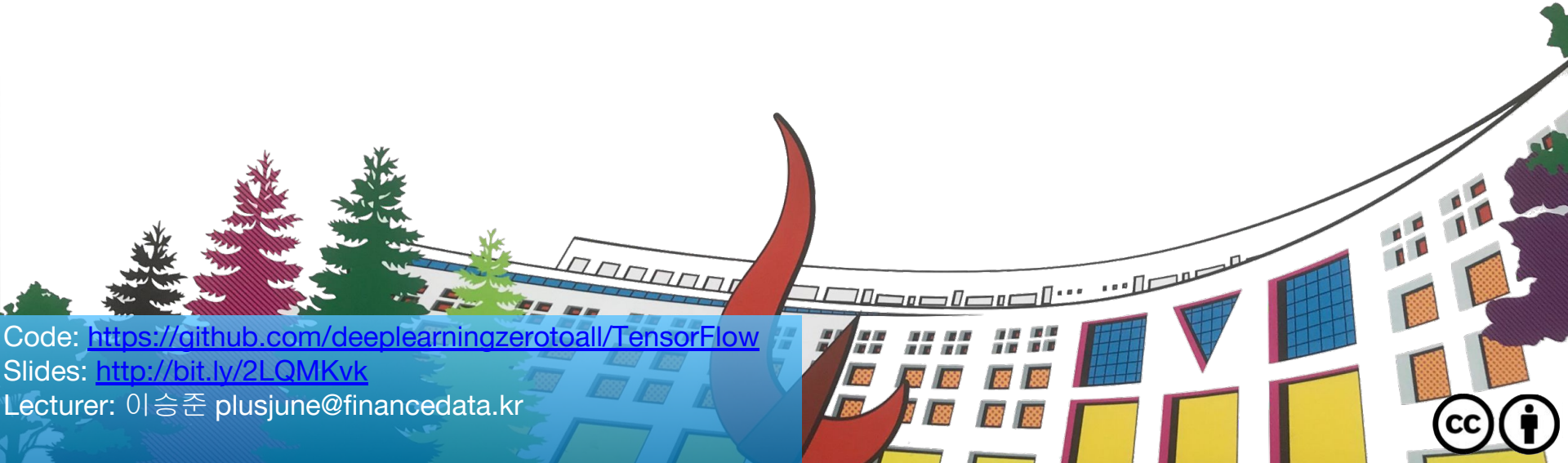
ML/DL for Everyone Season2

with TensorFlow

02 - Simple Linear Regression LAB



Code: https://github.com/deeplearningzerotoall/TensorFlow
Slides: http://bit.ly/2LQMKvk
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Hypothesis and Cost

Hypothesis $H(x) = Wx + b$

Cost $$cost(W, b) = \frac{1}{m} \sum_{i=1}^{m} (H(x^{(i)}) - y^{(i)})^2$$

Build hypothesis and cost

$$H(x) = Wx + b$$

```
x_data = [1, 2, 3, 4, 5]
y_data = [1, 2, 3, 4, 5]

W = tf.Variable(2.9)
b = tf.Variable(0.5)

# hypothesis = W * x + b
hypothesis = W * x_data + b
```

$$cost(W, b) = \frac{1}{m} \sum_{i=1}^{m} (H(x^{(i)}) - y^{(i)})^2$$

```
cost = tf.reduce_mean(tf.square(hypothesis - y_data))
```

Build hypothesis and cost

$$cost(W, b) = \frac{1}{m} \sum_{i=1}^{m} (H(x^{(i)}) - y^{(i)})^2$$

```
cost = tf.reduce_mean(tf.square(hypothesis - y_data))
```

- tf.reduce_mean()

```
v = [1., 2., 3., 4.]
tf.reduce_mean(v) # 2.5
```

- tf.square()

```
tf.square(3) # 9
```

Gradient descent

$$\underset{W,b}{minimize}\ cost(W,b)$$

```
# learning_rate initialize
learning_rate = 0.01

# Gradient descent
with tf.GradientTape() as tape:
    hypothesis = W * x_data + b
    cost = tf.reduce_mean(tf.square(hypothesis - y_data))
W_grad, b_grad = tape.gradient(cost, [W, b])

W.assign_sub(learning_rate * W_grad)
b.assign_sub(learning_rate * b_grad)
```

GradientTape()은 보통 with 구문과 같이 쓰이는데, with 구문 안의 변수들의 변화(기록)를 tape에 기록

여기서는 W와 b에

이후에 tape의 gradient 메서드를 호출해서. 경사도(미분값)을 구한다

gradient(cost, [W, b])는 함수 cost의 변수 W, b에 대한 개별 미분값(기울기)을. 구해서 tuple로 반환

```
A.assign_sub(B)

A = A - B
A -= B
```

Parameter(W,b) Update

```
W = tf.Variable(2.9)
b = tf.Variable(0.5)

for i in range(100):
    # Gradient descent
    with tf.GradientTape() as tape:
        hypothesis = W * x_data + b
        cost = tf.reduce_mean(tf.square(hypothesis - y_data))
    W_grad, b_grad = tape.gradient(cost, [W, b])
    W.assign_sub(learning_rate * W_grad)
    b.assign_sub(learning_rate * b_grad)
    if i % 10 == 0:
      print("{:5}|{:10.4}|{:10.4}|{:10.6f}".format(i, W.numpy(), b.numpy(), cost))
```

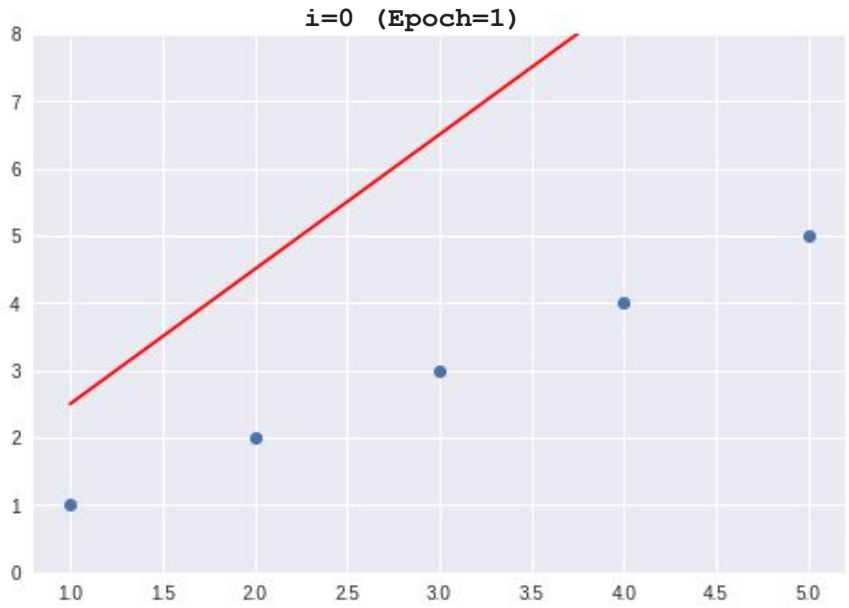
Full Code (less than 20 lines)

```
import tensorflow as tf
tf.enable_eager_execution()

# Data
x_data = [1, 2, 3, 4, 5]
y_data = [1, 2, 3, 4, 5]

# W, b initialize
W = tf.Variable(2.9)
b = tf.Variable(0.5)

learning_rate = 0.01

for i in range(100+1): # W, b update
    # Gradient descent
    with tf.GradientTape() as tape:
        hypothesis = W * x_data + b
        cost = tf.reduce_mean(tf.square(hypothesis - y_data))
    W_grad, b_grad = tape.gradient(cost, [W, b])
    W.assign_sub(learning_rate * W_grad)
    b.assign_sub(learning_rate * b_grad)
    if i % 10 == 0:
      print("{:5}|{:10.4f}|{:10.4}|{:10.6f}".format(i, W.numpy(), b.numpy(), cost))
```

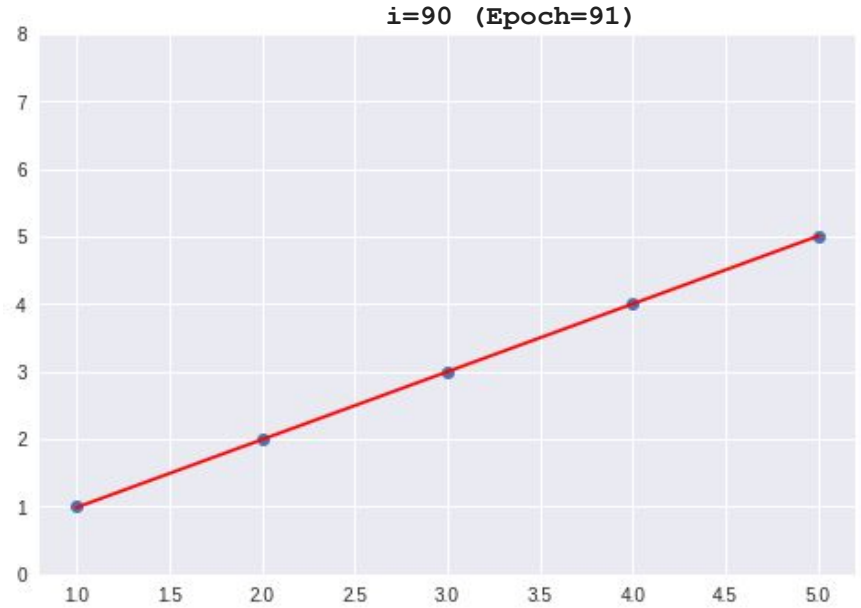
```
    i         W          b        cost
    0|    2.4520|    0.3760| 45.660004
   10|    1.1036|    0.0034|  0.206336
   20|    1.0128|   -0.0209|  0.001026
   30|    1.0065|   -0.0218|  0.000093
   40|    1.0059|   -0.0212|  0.000083
   50|    1.0057|   -0.0205|  0.000077
   60|    1.0055|   -0.0198|  0.000072
   70|    1.0053|   -0.0192|  0.000067
   80|    1.0051|   -0.0185|  0.000063
   90|    1.0050|   -0.0179|  0.000059
```

Training

W = tf.Variable(2.9)
b = tf.Variable(0.5)



W = 2.4520
b = 0.3760



W = 1.0050
b = -0.0179

Predict

Hypothesis $H(x) = Wx + b$

```
# Data
x_data = [1, 2, 3, 4, 5]
y_data = [1, 2, 3, 4, 5]
```

```
print(W * 5 + b)
print(W * 2.5 + b)
```

```
tf.Tensor(5.0066934, shape=(), dtype=float32)
tf.Tensor(2.4946523, shape=(), dtype=float32)
```

What’s Next?

- How to minimize cost