Multi-variable linear regression

Lecture 04

Hypothesis using matrix

$$H(x_1, x_2, x_3) = x_1w_1 + x_2w_2 + x_3w_3 \cancel{+ b}$$

Scores for exam

x_1	x_2	x_3	Y
73	80	75	152
93	88	93	185
89	91	90	180
96	98	100	196
73	66	70	142

Hypothesis using matrix

$$H(x_1, x_2, x_3) = x_1w_1 + x_2w_2 + x_3w_3 + b$$

x_1	x_2	x_3	Y
73	80	75	152
93	88	93	185
89	91	90	180
96	98	100	196
73	66	70	142

Test Scores for General Psychology

$$H(x_1, x_2, x_3) = x_1w_1 + x_2w_2 + x_3w_3 + b$$

```
x1_data = [73., 93., 89., 96., 73.]
x2_data = [80., 88., 91., 98., 66.]
x3_data = [75., 93., 90., 100., 70.]
y_data = [152., 185., 180., 196., 142.]

# placeholders for a tensor that will be always fed.
x1 = tf.placeholder(tf.float32)
x2 = tf.placeholder(tf.float32)
x3 = tf.placeholder(tf.float32)

Y = tf.placeholder(tf.float32)

w1 = tf.Variable(tf.random_normal([1]), name='weight1')
w2 = tf.Variable(tf.random_normal([1]), name='weight2')
w3 = tf.Variable(tf.random_normal([1]), name='weight3')
b = tf.Variable(tf.random_normal([1]), name='bias')

hypothesis = x1 * w1 + x2 * w2 + x3 * w3 + b
```

ex04_1.ipynb

```python
import tensorflow as tf
x1_data = [73., 93., 89., 96., 73.]
x2_data = [80., 88., 91., 98., 66.]
x3_data = [75., 93., 90., 100., 70.]
y_data = [152., 185., 180., 196., 142.]

# placeholders for a tensor that will be always fed.
x1 = tf.placeholder(tf.float32)
x2 = tf.placeholder(tf.float32)
x3 = tf.placeholder(tf.float32)
Y = tf.placeholder(tf.float32)

w1 = tf.Variable(tf.random_normal([1]), name='weight1')
w2 = tf.Variable(tf.random_normal([1]), name='weight2')
w3 = tf.Variable(tf.random_normal([1]), name='weight3')
b = tf.Variable(tf.random_normal([1]), name='bias')
hypothesis = x1 * w1 + x2 * w2 + x3 * w3 + b

# cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))
# Minimize. Need a very small learning rate for this data set
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)

# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())
for step in range(201):
   cost_val, hy_val, _ = sess.run([cost, hypothesis, train],
                        feed_dict={x1: x1_data, x2: x2_data, x3: x3_data, Y: y_data})
   if step % 10 == 0:
       print(step, "Cost: ", cost_val, "\nPrediction:\n", hy_val)
```

```
0 Cost:  183483.22
Prediction:
 [-224.89159 -274.88824 -268.49365 -291.39618 -211.79367]
10 Cost:  13.319193
Prediction:
 [154.009    180.54523 180.24066 197.2651  135.59247]
20 Cost:  11.583258
Prediction:
 [155.14319 181.93164 181.5947  198.74045 136.65503]
30 Cost:  11.527212
Prediction:
 [155.13443 181.94423 181.59512 198.74173 136.6697 ]
...

180 Cost:  10.721645
Prediction:
 [154.95505 182.068   181.54114 198.69507 136.83853]
190 Cost:  10.67021
Prediction:
 [154.94334 182.07607 181.53764 198.69203 136.84956]
200 Cost:  10.619032
Prediction:
 [154.93169 182.08412 181.5341  198.68898 136.86055]
```

```
x1_data = [73., 93., 89., 96., 73.]
x2_data = [80., 88., 91., 98., 66.]
x3_data = [75., 93., 90., 100., 70.]

y_data = [152., 185., 180., 196., 142.]
```

ex04_1.ipynb

```
import tensorflow as tf
x1_data = [73., 93., 89., 96., 73.]
x2_data = [80., 88., 91., 98., 66.]
x3_data = [75., 93., 90., 100., 70.]
y_data = [152., 185., 180., 196., 142.]

# placeholders for a tensor that will be always fed.
x1 = tf.placeholder(tf.float32)
x2 = tf.placeholder(tf.float32)
x3 = tf.placeholder(tf.float32)
Y = tf.placeholder(tf.float32)

w1 = tf.Variable(tf.random_normal([1]), name='weight1')
w2 = tf.Variable(tf.random_normal([1]), name='weight2')
w3 = tf.Variable(tf.random_normal([1]), name='weight3')
b = tf.Variable(tf.random_normal([1]), name='bias')
hypothesis = x1 * w1 + x2 * w2 + x3 * w3 + b

# cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))
# Minimize. Need a very small learning rate for this data set
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)

# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())
```

Print

Next slide

```
                                                        true value : [152.0, 185.0, 180.0, 196.0, 142.0]
0        Cost:  68719.125      Prediction: [ -80.06516   -95.63857   -94.42629  -103.596535  -72.279   ]
10       Cost:  1.3717095      Prediction: [151.827   183.08395 180.20096 195.46593 140.31721]
20       Cost:  0.7396033      Prediction: [152.52573 183.92926 181.03099 196.37012 140.96307]
30       Cost:  0.7366053      Prediction: [152.52498 183.93379 181.03262 196.37221 140.96764]
40       Cost:  0.7336332      Prediction: [152.52211 183.93575 181.03174 196.37155 140.97025]
50       Cost:  0.73065394     Prediction: [152.51924 183.93773 181.03087 196.37088 140.97287]
60       Cost:  0.7277094      Prediction: [152.51639 183.9397  181.03    196.37024 140.97546]
70       Cost:  0.72477674     Prediction: [152.51353 183.94168 181.02916 196.36958 140.97806]
80       Cost:  0.721859       Prediction: [152.51068 183.9436  181.02826 196.36893 140.98064]
90       Cost:  0.7189571      Prediction: [152.50786 183.94556 181.02739 196.36829 140.98322]
100      Cost:  0.71607697     Prediction: [152.50502 183.94748 181.02652 196.36763 140.98578]
110      Cost:  0.7132072      Prediction: [152.5022  183.94943 181.02568 196.36697 140.98834]
120      Cost:  0.7103611      Prediction: [152.49939 183.95135 181.02483 196.36632 140.99089]
130      Cost:  0.7075125      Prediction: [152.49658 183.95328 181.02396 196.36568 140.99345]
140      Cost:  0.7046921      Prediction: [152.4938  183.95522 181.02312 196.36505 140.996  ]
.
.
.
410      Cost:  0.63397604     Prediction: [152.42107 184.00511 181.0009  196.34828 141.06209]
420      Cost:  0.63154304     Prediction: [152.41849 184.00691 181.00012 196.3477  141.06447]
430      Cost:  0.6291391      Prediction: [152.4159  184.00867 180.99933 196.34709 141.0668 ]
440      Cost:  0.6267311      Prediction: [152.41333 184.01045 180.99854 196.3465  141.06915]
450      Cost:  0.6243508      Prediction: [152.41075 184.0122  180.99776 196.3459  141.07149]
460      Cost:  0.6219795      Prediction: [152.40819 184.01396 180.99698 196.3453  141.07382]
470      Cost:  0.6196192      Prediction: [152.40564 184.01572 180.9962  196.34473 141.07616]
480      Cost:  0.6172741      Prediction: [152.40308 184.01747 180.99542 196.34415 141.07846]
490      Cost:  0.6149209      Prediction: [152.40054 184.01924 180.99464 196.34355 141.0808 ]
500      Cost:  0.6126008      Prediction: [152.398   184.02097 180.99387 196.34296 141.0831 ]
```

Matrix

$$\begin{pmatrix} x_1 & x_2 & x_3 \end{pmatrix} \cdot \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix} = \begin{pmatrix} x_1 w_1 + x_2 w_2 + x_3 w_3 \end{pmatrix}$$

$$H(X) = XW$$

Matrix

$$\begin{pmatrix} x_1 & x_2 & x_3 \end{pmatrix} \cdot \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix} = \begin{pmatrix} x_1w_1 + x_2w_2 + x_3w_3 \end{pmatrix}$$

$$H(X) = XW$$

x_1	x_2	x_3	Y
73	80	75	152
93	88	93	185
89	91	90	180
96	98	100	196
73	66	70	142

```
x1_data = [73., 93., 89., 96., 73.]
x2_data = [80., 88., 91., 98., 66.]
x3_data = [75., 93., 90., 100., 70.]

y_data = [152., 185., 180., 196., 142.]
```

```
x_data = [[73., 80., 75.], [93., 88., 93.],
          [89., 91., 90.], [96., 98., 100.], [73., 66., 70.]]
y_data = [[152.], [185.], [180.], [196.], [142.]]


# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 3])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([3, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis
hypothesis = tf.matmul(X, W) + b
```

```python
import tensorflow as tf
x_data = [[73., 80., 75.], [93., 88., 93.],[89., 91., 90.], [96., 98., 100.], [73., 66., 70.]]
y_data = [[152.], [185.], [180.], [196.], [142.]]
# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 3])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([3, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis
hypothesis = tf.matmul(X, W) + b
# Simplified cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))
# Minimize
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)

# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())

for step in range(201):
    cost_val, hy_val, _ = sess.run([cost, hypothesis, train], feed_dict={X: x_data, Y: y_data})
    if step % 10 == 0:
        print(step, "Cost: ", cost_val, "\nPrediction:\n", hy_val)
```

x_1	x_2	x_3	Y
73	80	75	152
93	88	93	185
89	91	90	180
96	98	100	196
73	66	70	142

```
0 Cost:  10480.361
Prediction:
 [[65.108696]
 [72.39651 ]
 [74.32275 ]
 [81.11035 ]
 [53.65494 ]]
10 Cost:  12.366552
Prediction:
 [[155.6036 ]
 [181.18958]
 [181.50548]
 [197.8308 ]
 [136.6419 ]]
20 Cost:  12.207312
Prediction:
 [[155.86429]
 [181.52776]
 [181.82576]
 [198.18076]
 [136.90508]]
.
.
.
.
180 Cost:  11.237604
Prediction:
 [[155.65942]
 [181.67027]
 [181.76436]
 [198.13177]
 [137.0957 ]]
190 Cost:  11.179713
Prediction:
 [[155.64687]
 [181.67892]
 [181.76056]
 [198.12872]
 [137.10732]]
200 Cost:  11.122178
Prediction:
 [[155.63435]
 [181.68753]
 [181.75677]
 [198.12567]
 [137.1189 ]]
```

```
x1_data = [73., 93., 89., 96., 73.]
x2_data = [80., 88., 91., 98., 66.]
x3_data = [75., 93., 90., 100., 70.]

y_data = [152., 185., 180., 196., 142.]
```

reshape

```
import numpy as np
x = np.arange(12).reshape(3, 4)
print("x.shape :",x.shape)
print("x : \n", x)
print("x.reshape \n", x.reshape(-1,2))
print("x.reshape \n", x.reshape(2,-1))
```

```
x.shape : (3, 4)
x :
 [[ 0  1  2  3]
 [ 4  5  6  7]
 [ 8  9 10 11]]
x.reshape
 [[ 0  1]
 [ 2  3]
 [ 4  5]
 [ 6  7]
 [ 8  9]
 [10 11]]
x.reshape
 [[ 0  1  2  3  4  5]
 [ 6  7  8  9 10 11]]
```

```python
import tensorflow as tf
x_data = [[73., 80., 75.], [93., 88., 93.],[89., 91., 90.], [96., 98., 100.], [73., 66., 70.]]
y_data = [[152.], [185.], [180.], [196.], [142.]]
# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 3])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([3, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis
hypothesis = tf.matmul(X, W) + b
# Simplified cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))
# Minimize
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)

# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())
```

x_1	x_2	x_3	Y
73	80	75	152
93	88	93	185
89	91	90	180
96	98	100	196
73	66	70	142

Print

Next slide

```
true value :  [[152.0], [185.0], [180.0], [196.0], [142.0]]
0 Cost:  11856.827
hypothesis shape : (5, 1)
hypothesis prediction
[[56.847008]
 [67.03378 ]
 [66.55113 ]
 [73.52583 ]
 [50.111755]]
hypothesis (Convert to row vector) ->  [[56.847008 67.03378  66.55113  73.52583  50.111755]]
================================================================================
true value :  [[152.0], [185.0], [180.0], [196.0], [142.0]]
10 Cost:  4.4845324
hypothesis shape : (5, 1)
hypothesis prediction
[[153.14717]
 [182.79272]
 [180.6035 ]
 [197.72633]
 [138.40971]]
hypothesis (Convert to row vector) ->  [[153.14717 182.79272 180.6035  197.72633 138.40971]]
================================================================================
true value :  [[152.0], [185.0], [180.0], [196.0], [142.0]]
20 Cost:  4.3570404
hypothesis shape : (5, 1)
hypothesis prediction
[[153.43153]
 [183.1478 ]
 [180.94647]
 [198.10019]
 [138.68358]]
hypothesis (Convert to row vector) ->  [[153.43153 183.1478  180.94647 198.10019 138.68358]]
================================================================================
.
.
```

```
true value :  [[152.0], [185.0], [180.0], [196.0], [142.0]]
180 Cost:  4.0664644
hypothesis shape : (5, 1)
hypothesis prediction
[[153.32271]
 [183.22476]
 [180.91478]
 [198.07086]
 [138.7897 ]]
hypothesis (Convert to row vector) ->  [[153.32271 183.22476 180.91478 198.07086 138.7897 ]]
==================================================================================
true value :  [[152.0], [185.0], [180.0], [196.0], [142.0]]
190 Cost:  4.049096
hypothesis shape : (5, 1)
hypothesis prediction
[[153.31602]
 [183.2294 ]
 [180.91278]
 [198.069  ]
 [138.79616]]
hypothesis (Convert to row vector) ->  [[153.31602 183.2294  180.91278 198.069   138.79616]]
==================================================================================
true value :  [[152.0], [185.0], [180.0], [196.0], [142.0]]
200 Cost:  4.03183
hypothesis shape : (5, 1)
hypothesis prediction
[[153.30934]
 [183.23402]
 [180.91078]
 [198.06712]
 [138.80257]]
hypothesis (Convert to row vector) ->  [[153.30934 183.23402 180.91078 198.06712 138.80257]]
==================================================================================
```

Loading Data from File

Slicing

index 0 1 2 3 4

```
nums = [ 0,1,2,3,4]     # range is a built-in function that creates a list of integers
nums                    # Prints "[0, 1, 2, 3, 4]"
nums[2:4]               # Get a slice from index 2 to 4 (exclusive); prints "[2, 3]"
nums[2:]                # Get a slice from index 2 to the end; prints "[2, 3, 4]"
nums[:2]                # Get a slice from the start to index 2 (exclusive); prints "[0, 1]"
nums[:]                 # Get a slice of the whole list; prints ["0, 1, 2, 3, 4]"
nums[:-1]               # Slice indices can be negative; prints ["0, 1, 2, 3]"
nums[2:4]=[8,9]         # Assign a new sublist to a slice
nums                    # Prints "[0, 1, 8, 9, 4]"
```

Slicing

```
c=[[1,2,3,4], [5,6,7,8], [9,10,11,12]]
print (c)
type(c)
```

비교

```
[[1, 2, 3, 4], [5, 6, 7, 8], [9, 10, 11, 12]]
list
```

```
import numpy as np
a=np.array([1,2,3,4,5])
a
array([1, 2, 3, 4, 5])
a[1:3]
array([2, 3])
a[-1]
5
a[0:2]=9
a
array([9, 9, 3, 4, 5])
```

```
b=np.array([[1,2,3,4], [5,6,7,8], [9,10,11,12]])
b
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
b[:,1]
array([ 2,  6, 10])
b[-1]    # b[-1, :] 동일한표현
array([ 9, 10, 11, 12])
type(b)
numpy.ndarray
```

1	2	3	4
5	6	7	8
9	10	11	12

```
b[-1, :]
array([ 9, 10, 11, 12])
b[-1, ...]
array([ 9, 10, 11, 12])
b[0:2, :]
array([[1, 2, 3, 4],
       [5, 6, 7, 8]])
```

tf.random_

균등한 확률로 랜덤값이 나오게 하려면 → uniform
범위내에서 종모양의 정규분포에 따라 값이 랜덤값이 나오게 하려면 → normal

```
import tensorflow as tf
a=tf.random_uniform([1])
b=tf.random_normal([1])
print("Session 1")
with tf.Session() as sess1:
    print(sess1.run(a))
    print(sess1.run(a))
    print(sess1.run(b))
    print(sess1.run(b))

print("Session 2")
with tf.Session() as sess2:
    print(sess2.run(a))
    print(sess2.run(a))
    print(sess2.run(b))
    print(sess2.run(b))
```

```
Session 1
[0.11832285]
[0.905094]
[0.3956182]
[0.4454496]
Session 2
[0.05520594]
[0.1945405]
[0.12527454]
[0.12360418]
```

tf.random_

```
import tensorflow as tf
a=tf.random_uniform([1])
b=tf.random_normal([1])
print("Session 1")
with tf.Session() as sess1:
    print(sess1.run(a))
    print(sess1.run(a))
    print(sess1.run(b))
    print(sess1.run(b))

print("Session 2")
with tf.Session() as sess2:
    print(sess2.run(a))
    print(sess2.run(a))
    print(sess2.run(b))
    print(sess2.run(b))
```

```
Session 1
[0.11832285]
[0.905094]
[0.3956182]
[0.4454496]
Session 2
[0.05520594]
[0.1945405]
[0.12527454]
[0.12360418]
```

```
import tensorflow as tf
a=tf.random_uniform([1], seed=1)
b=tf.random_uniform([1])
print("Session 1")
with tf.Session() as sess1:
    print(sess1.run(a))
    print(sess1.run(a))
    print(sess1.run(b))
    print(sess1.run(b))

print("Session 2")
with tf.Session() as sess2:
    print(sess2.run(a))
    print(sess2.run(a))
    print(sess2.run(b))
    print(sess2.run(b))
```

```
Session 1
[0.2390374]
[0.22267115]
[0.15651464]
[0.47944522]
Session 2
[0.2390374]
[0.22267115]
[0.6993104]
[0.39458954]
```

=

tf.random_

```
import tensorflow as tf
a=tf.random_uniform([2,2],-1,4) #shape, mean, standard deviation
b=tf.random_normal([1,2],-1,4) #shape, mean, standard deviation
print("Session 1","="*20)
with tf.Session() as sess1:
    print("a : ",sess1.run(a))
    print("a : ",sess1.run(a))
    print("b : ",sess1.run(b))
    print("b : ",sess1.run(b))

print("\nSession 2","="*20)
with tf.Session() as sess2:
    print("a : ",sess2.run(a))
    print("a : ",sess2.run(a))
    print("b : ",sess2.run(b))
    print("b : ",sess2.run(b))
```

```
Session 1 ====================
a :  [[ 0.46835685 -0.9140465 ]
 [-0.43962872  2.0696054 ]]
a :  [[-0.24747825  0.44044995]
 [ 3.5657067   2.804232  ]]
b :  [[-4.631923  -3.6227627]]
b :  [[-1.7505416  1.4698434]]

Session 2 ====================
a :  [[-0.59933937 -0.01183367]
 [ 1.99195     2.9339738 ]]
a :  [[ 3.449287    2.597684  ]
 [ 0.67940617 -0.03768122]]
b :  [[-1.7212455  0.7322532]]
b :  [[1.9086502 1.4359376]]
```

tf.random_

```
import tensorflow as tf
a=tf.random_uniform([2,2],-1,4,seed=7) #shape, mean, standard deviation
b=tf.random_normal([1,2],-1,4) #shape, mean, standard deviation
print("Session 1","="*20)
with tf.Session() as sess1:
    print("a : ",sess1.run(a))
    print("a : ",sess1.run(a))
    print("b : ",sess1.run(b))
    print("b : ",sess1.run(b))

print("\nSession 2","="*20)
with tf.Session() as sess2:
    print("a : ",sess2.run(a))
    print("a : ",sess2.run(a))
    print("b : ",sess2.run(b))
    print("b : ",sess2.run(b))
```

```
Session 1 ====================
a :  [[ 1.4197049   1.5310154 ]
 [ 0.2757188  -0.37628865]]
a :  [[ 0.52801156  3.8846369 ]
 [-0.3537575  -0.52644885]]
b :  [[-3.5266707  7.6168528]]
b :  [[-3.800884  -3.8644233]]

Session 2 ====================
a :  [[ 1.4197049   1.5310154 ]
 [ 0.2757188  -0.37628865]]
a :  [[ 0.52801156  3.8846369 ]
 [-0.3537575  -0.52644885]]
b :  [[-2.7445269 -0.8103109]]
b :  [[-2.4123158  5.2338667]]
```

=

tf.random_

```
import tensorflow as tf
tf.set_random_seed(777)   #shape, start value, end value

a=tf.random_uniform([1])   #shape, start value, end value
b=tf.random_normal([1,2])   #shape, start value, end value
print("Session 1","="*20)

with tf.Session() as sess1:
    print("a : ",sess1.run(a))
    print("a : ",sess1.run(a))
    print("b : ",sess1.run(b))
    print("b : ",sess1.run(b))

print("\nSession 2","="*20)
with tf.Session() as sess2:
    print("a : ",sess2.run(a))
    print("a : ",sess2.run(a))
    print("b : ",sess2.run(b))
    print("b : ",sess2.run(b))
```

```
Session 1 ====================
a :  [0.1003145]
a :  [0.4195832]
b :  [[-1.6822096   0.05430611]]
b :  [[-0.28773162 -0.46478754]]

Session 2 ====================
a :  [0.1003145]
a :  [0.4195832]
b :  [[-1.6822096   0.05430611]]
b :  [[-0.28773162 -0.46478754]]
```

=

Loading data from file

data-01-test-score.csv

x_data			y_data
73	80	75	152
93	88	93	185
89	91	90	180
96	98	100	196
73	66	70	142
53	46	55	101
69	74	77	149
47	56	60	115
87	79	90	175
79	70	88	164
69	70	73	141
70	65	74	141
93	95	91	184
79	80	73	152
70	73	78	148
93	89	96	192
78	75	68	147
81	90	93	183
88	92	86	177
78	83	77	159
82	86	90	177
86	82	89	175
78	83	85	175
76	83	71	149
96	93	95	192

comma-separated values 파일

```python
import numpy as np
xy = np.loadtxt('g:\\data-01-test-score.csv', delimiter=',', dtype=np.float32)
x_data = xy[:, 0:-1]
y_data = xy[:, [-1]]
# Make sure the shape and data are OK
print("x_data.shape :", x_data.shape, ", len(x_data) : ", len(x_data))
print( x_data)
print("y_data.shape :", y_data.shape, ", len(y_data) : ", len(y_data))
print(y_data)
```

x_data.shape : (25, 3) , len(x_data) : 25

y_data.shape : (25, 1) , len(y_data) : 25

```python
import tensorflow as tf
import numpy as np
tf.set_random_seed(777)  # for reproducibility 난수발생의 초기값을 주면 실행할 때마다 같은 결과가 나온다.

xy = np.loadtxt('g:\\data-01-test-score.csv', delimiter=',', dtype=np.float32)
x_data = xy[:, 0:-1]
y_data = xy[:, [-1]]

# Make sure the shape and data are OK
print("x_data.shape :", x_data.shape, ", len(x_data) : ", len(x_data))
print( x_data)
print("y_data.shape :", y_data.shape, ", len(y_data) : ", len(y_data))
print(y_data)

# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 3])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([3, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis
hypothesis = tf.matmul(X, W) + b

# Simplified cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))

# Minimize
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)
```

```
# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())
# Set up feed_dict variables inside the loop.
for step in range(101):
   cost_val, w_val, hy_val, _  = sess.run([cost, W, hypothesis, train],feed_dict={X: x_data, Y: y_data})
   if step % 10 == 0:
       print("-"*5, "step :",step, "-"*5, "> cost : (", cost_val ,")")
       print("x data : \n", x_data)
       print("W : \n", w_val)
       print("sess.run(W) : \n", sess.run(W))
       print("sess.run(b) : \n", sess.run(b))
       print("hypothesis : \n", hy_val)


print("="*30)
print("Final cost : ", cost_val) # final cost value 확인
print("Final W : \n", w_val)   # final W value 확인
print("Final sess.run(W) : \n", sess.run(W)) # W 확인
Print( " Final sess.run(b) : \n " , sess.run(b)) # b 확인
print("Final hypothesis : \n", hy_val) # final hypothesis value 확인

# Ask my score
```

~~~~~~
If the input data value then [100, 70, 101]
score will be
[[216.60124]]

If the input data value then [60, 70, 110], [90, 100, 80]
scores will be
[[171.78261]
[166.04927]]
~~~~~~

```
print("x_data.shape :", x_data.shape, ", len(x_data) : ", len(x_data))
print( x_data)
print("y_data.shape :", y_data.shape, ", len(y_data) : ", len(y_data))
print(y_data)
```

```
73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192
```

```
x_data.shape : (25, 3) , len(x_data) :  25
[[ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]
 [ 53.  46.  55.]
 [ 69.  74.  77.]
 [ 47.  56.  60.]
 [ 87.  79.  90.]
 [ 79.  70.  88.]
 [ 69.  70.  73.]
 [ 70.  65.  74.]
 [ 93.  95.  91.]
 [ 79.  80.  73.]
 [ 70.  73.  78.]
 [ 93.  89.  96.]
 [ 78.  75.  68.]
 [ 81.  90.  93.]
 [ 88.  92.  86.]
 [ 78.  83.  77.]
 [ 82.  86.  90.]
 [ 86.  82.  89.]
 [ 78.  83.  85.]
 [ 76.  83.  71.]
 [ 96.  93.  95.]]
```

```
y_data.shape : (25, 1) , len(y_data) :  25
[[152.]
 [185.]
 [180.]
 [196.]
 [142.]
 [101.]
 [149.]
 [115.]
 [175.]
 [164.]
 [141.]
 [141.]
 [184.]
 [152.]
 [148.]
 [192.]
 [147.]
 [183.]
 [177.]
 [159.]
 [177.]
 [175.]
 [175.]
 [149.]
 [192.]]
```

```
print("-"*5, "step :",step, "-"*5, "> cost : (", cost_val ,")")
print("x data : \n", x_data)
print("W : \n", w_val)
print("sess.run(W) : \n", sess.run(W))
print("sess.run(b) : \n", sess.run(b))
print("hypothesis : \n", hy_val)
```

```
73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192
```

```
----- step : 0 ----- > cost : ( 6124.322 )
x data :
 [[ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]
 [ 53.  46.  55.]
 [ 69.  74.  77.]
 [ 47.  56.  60.]
 [ 87.  79.  90.]
 [ 79.  70.  88.]
 [ 69.  70.  73.]
 [ 70.  65.  74.]
 [ 93.  95.  91.]
 [ 79.  80.  73.]
 [ 70.  73.  78.]
 [ 93.  89.  96.]
 [ 78.  75.  68.]
 [ 81.  90.  93.]
 [ 88.  92.  86.]
 [ 78.  83.  77.]
 [ 82.  86.  90.]
 [ 86.  82.  89.]
 [ 78.  83.  85.]
 [ 76.  83.  71.]
 [ 96.  93.  95.]]
W :
 [[ 1.5859851 ]
 [-0.29999283]
 [ 1.3056532 ]]
sess.run(W) :
 [[ 1.5859851 ]
 [-0.29999283]
 [ 1.3056532 ]]
sess.run(b) :
 [1.2055854]
hypothesis :
 [[74.180595]
 [80.63322 ]
 [83.980225]
 [91.3227  ]
 [59.210712]
 [41.890907]
 [70.11859 ]
 [54.823997]
 [72.922676]
 [66.100105]
 [65.148254]
 [60.243664]
 [86.905014]
 [71.78623 ]
 [69.10599 ]
 [82.41498 ]
 [65.882515]
 [86.28957 ]
 [84.18406 ]
 [76.09278 ]
 [81.279625]
 [75.88126 ]
 [78.24949 ]
 [75.09364 ]
 [85.10978 ]]
```

```
print("-"*5, "step :",step, "-"*5, "> cost : (", cost_val ,")")
print("x data : \n", x_data)
print("W : \n", w_val)
print("sess.run(W) : \n", sess.run(W))
print("sess.run(b) : \n", sess.run(b))
print("hypothesis : \n", hy_val)
```

```
73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192
```

```
----- step : 100 ----- > cost : ( 35.186806 )
x data :
 [[ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]
 [ 53.  46.  55.]
 [ 69.  74.  77.]
 [ 47.  56.  60.]
 [ 87.  79.  90.]
 [ 79.  70.  88.]
 [ 69.  70.  73.]
 [ 70.  65.  74.]
 [ 93.  95.  91.]
 [ 79.  80.  73.]
 [ 70.  73.  78.]
 [ 93.  89.  96.]
 [ 78.  75.  68.]
 [ 81.  90.  93.]
 [ 88.  92.  86.]
 [ 78.  83.  77.]
 [ 82.  86.  90.]
 [ 86.  82.  89.]
 [ 78.  83.  85.]
 [ 76.  83.  71.]
 [ 96.  93.  95.]]
W :
 [[ 1.3675066]
 [-0.4606597]
 [ 1.0979582]]
sess.run(W) :
 [[ 1.3675066]
 [-0.4606597]
 [ 1.0979582]]
sess.run(b) :
 [1.202987]
hypothesis :
 [[146.52287]
 [189.95477]
 [179.80666]
 [197.13441]
 [147.48653]
 [112.88066]
 [146.01387]
 [105.55443]
 [182.60304]
 [173.61385]
 [143.46568]
 [148.23643]
 [184.53175]
 [152.53331]
 [148.94067]
 [192.78792]
 [147.9803 ]
 [172.61974]
 [173.58574]
 [154.17473]
 [172.53734]
 [178.75427]
 [162.95908]
 [144.85098]
 [193.94914]]
```

```
print("="*30)
print("Final cost : ", cost_val)
print("Final W : \n", w_val)
print("Final sess.run(W) : \n", sess.run(W))
print("Final sess.run(b) : \n", sess.run(b))
print("Final hypothesis : \n", hy_val)
```

```
73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192
```

```
==============================
Final cost :  35.186806
Final W :
 [[ 1.3675066]
 [-0.4606597]
 [ 1.0979582]]
Final sess.run(W) :
 [[ 1.3675066]
 [-0.4606597]
 [ 1.0979582]]
Final sess.run(b) :
 [1.202987]
```

```
Final hypothesis :
 [[146.52287]
 [189.95477]
 [179.80666]
 [197.13441]
 [147.48653]
 [112.88066]
 [146.01387]
 [105.55443]
 [182.60304]
 [173.61385]
 [143.46568]
 [148.23643]
 [184.53175]
 [152.53331]
 [148.94067]
 [192.78792]
 [147.9803 ]
 [172.61974]
 [173.58574]
 [154.17473]
 [172.53734]
 [178.75427]
 [162.95908]
 [144.85098]
 [193.94914]]
```

```
73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192
```

```
========================
Final cost :  35.186806
Final W :
 [[ 1.3675066]
 [-0.4606597]
 [ 1.0979582]]
Final sess.run(W) :
 [[ 1.3675066]
 [-0.4606597]
 [ 1.0979582]]
Final sess.run(b) :
 [1.202987]
```

```
Final hypothesis :
 [[146.52287]
 [189.95477]
 [179.80666]
 [197.13441]
 [147.48653]
 [112.88066]
 [146.01387]
 [105.55443]
 [182.60304]
 [173.61385]
 [143.46568]
 [148.23643]
 [184.53175]
 [152.53331]
 [148.94067]
 [192.78792]
 [147.9803 ]
 [172.61974]
 [173.58574]
 [154.17473]
 [172.53734]
 [178.75427]
 [162.95908]
 [144.85098]
 [193.94914]]
```

~~~~~~

If the input data value then [100, 70, 101]
score will be
[[216.60124]]

If the input data value then [60, 70, 110], [90, 100, 80]
scores will be
[[171.78261]
[166.04927]]
~~~~~~

data-01-test-score.csv 파일을 이용한 Self Test

Print
Next slide

```
print(x_data.shape, x_data, len(x_data))
```

```
print(y_data.shape, y_data)
```

```
print(step, "Cost: ", cost_val,
                    "\nPrediction:\n", hy_val)
```

```
(25, 3) [[ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]
 [ 53.  46.  55.]
 [ 69.  74.  77.]
 [ 47.  56.  60.]
 [ 87.  79.  90.]
 [ 79.  70.  88.]
 [ 69.  70.  73.]
 [ 70.  65.  74.]
 [ 93.  95.  91.]
 [ 79.  80.  73.]
 [ 70.  73.  78.]
 [ 93.  89.  96.]
 [ 78.  75.  68.]
 [ 81.  90.  93.]
 [ 88.  92.  86.]
 [ 78.  83.  77.]
 [ 82.  86.  90.]
 [ 86.  82.  89.]
 [ 78.  83.  85.]
 [ 76.  83.  71.]
 [ 96.  93.  95.]] 25
```

```
(25, 1) [[152.]
 [185.]
 [180.]
 [196.]
 [142.]
 [101.]
 [149.]
 [115.]
 [175.]
 [164.]
 [141.]
 [141.]
 [184.]
 [152.]
 [148.]
 [192.]
 [147.]
 [183.]
 [177.]
 [159.]
 [177.]
 [175.]
 [175.]
 [149.]
 [192.]]
```

```
0 Cost:  6794.88
Prediction:
 [[75.121445]
 [94.47313 ]
 [91.04281 ]
 [97.97375 ]
 [74.02787 ]
 [53.175064]
 [70.35249 ]
 [47.876087]
 [87.78398 ]
 [79.027596]
 [70.23902 ]
 [70.62783 ]
 [95.368126]
 [81.245766]
 [71.16429 ]
 [94.34674 ]
 [80.10899 ]
 [82.745514]
 [90.46315 ]
 [80.25856 ]
 [83.54958 ]
 [87.18368 ]
 [79.63953 ]
 [78.73298 ]
 [97.8319  ]]
```

```
10 Cost:  30.941683
Prediction:
 [[151.91267]
 [186.7695 ]
 [181.983  ]
 [197.0233 ]
 [144.41174]
 [105.07982]
 [144.5075 ]
 [102.86822]
 [174.05234]
 [158.95253]
 [141.67464]
 [141.06839]
 [189.31291]
 [159.32883]
 [145.6612 ]
 [188.01419]
 [154.4623 ]
 [171.74423]
 [180.02461]
 [160.39627]
 [170.50504]
 [173.77861]
 [162.54216]
 [156.136  ]
 [193.4822 ]]
```

```
100 Cost:  29.279634
Prediction:
 [[152.4106 ]
 [187.36853]
 [182.56651]
 [197.73706]
 [144.80415]
 [105.49004]
 [145.15811]
 [103.51313]
 [174.708  ]
 [159.73297]
 [142.2212 ]
 [141.63762]
 [189.83539]
 [159.65097]
 [146.32355]
 [188.6967 ]
 [154.67412]
 [172.57439]
 [180.51016]
 [160.8449 ]
 [171.24017]
 [174.41705]
 [163.22066]
 [156.45164]
 [194.06593]]
```

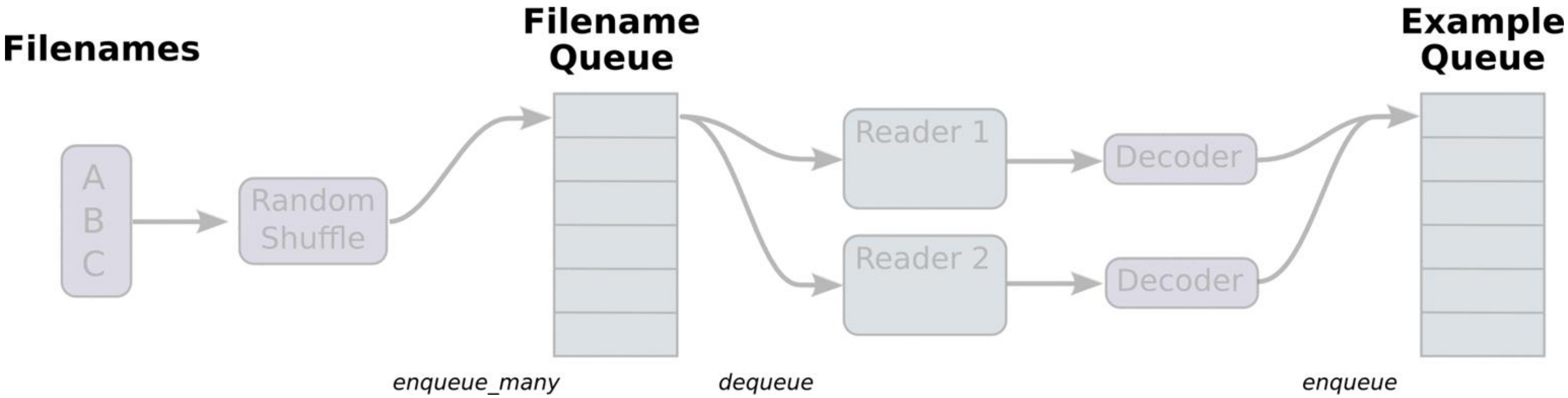
```
print("Your score will be ", sess.run(hypothesis,
                    feed_dict={X: [[100, 70, 101]]}))

print("Other scores will be ", sess.run(hypothesis,
                    feed_dict={X: [[60, 70, 110], [90, 100, 80]]}))
```

```
Your score will be
[[191.01485]]
Other scores will be
[[141.471  ]
 [184.83368]]
```

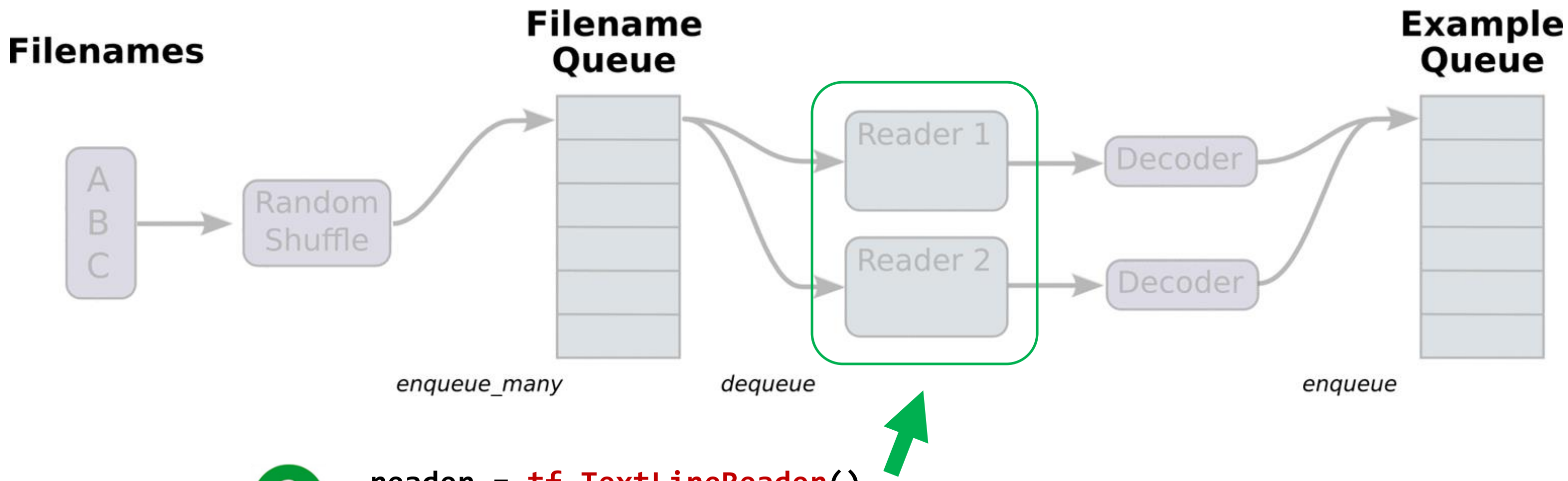
파일이 너무 크면
텐서플로에서는
Queue Runners(큐러너)를
사용한다.

Queue Runners



1
```
filename_queue = tf.train.string_input_producer(
    ['data-01-test-score.csv', 'data-02-test-score.csv', ... ],
    shuffle=False, name='filename_queue')
```

3
```
record_defaults = [[0.], [0.], [0.], [0.]]
xy = tf.decode_csv(value, record_defaults=record_defaults)
```



2
```
reader = tf.TextLineReader()
key, value = reader.read(filename_queue)
```

tf.train.batch

```python
# collect batches of csv in
train_x_batch, train_y_batch = \
    tf.train.batch([xy[0:-1], xy[-1:]], batch_size=10)
```

x_data y_data 10 line

```python
sess = tf.Session()
...

# Start populating the filename queue.
coord = tf.train.Coordinator()
threads = tf.train.start_queue_runners(sess=sess, coord=coord)

for step in range(101):
    x_batch, y_batch = sess.run([train_x_batch, train_y_batch])
    ...

coord.request_stop()
coord.join(threads)
```

```python
import tensorflow as tf
filename_queue = tf.train.string_input_producer(
    ['g:\\data-01-test-score.csv'], shuffle=False, name='filename_queue')

reader = tf.TextLineReader()
key, value = reader.read(filename_queue)

# Default values, in case of empty columns.
# Also specifies the type of the decoded result.
record_defaults = [[0.], [0.], [0.], [0.]]
xy = tf.decode_csv(value, record_defaults=record_defaults)

# collect batches of csv in
train_x_batch, train_y_batch = \
    tf.train.batch([xy[0:-1], xy[-1:]], batch_size=10)

# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 3])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([3, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis
hypothesis = tf.matmul(X, W) + b

# Simplified cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))


# Minimize
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)
```

```python
# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())

# Start populating the filename queue.
coord = tf.train.Coordinator()
threads = tf.train.start_queue_runners(sess=sess, coord=coord)

for step in range(101):
    x_batch, y_batch = sess.run([train_x_batch, train_y_batch])
    cost_val, hy_val, _ = sess.run(
        [cost, hypothesis, train],
        feed_dict={X: x_batch, Y: y_batch})
    if step % 10 == 0:
        print(step, "Cost: ", cost_val, "\nPrediction:\n", hy_val)

coord.request_stop()
coord.join(threads)
# Ask my score
print("Your score will be ",
      sess.run(hypothesis, feed_dict={X: [[100, 70, 101]]}))

print("Other scores will be ",
      sess.run(hypothesis, feed_dict={X: [[60, 70, 110], [90, 100, 80]]}))
```

```
0 Cost:  16549.555
Prediction:
 [[17.438633]
 [38.414707]
 [28.744263]
 [32.80502 ]
 [32.37227 ]
 [28.1679  ]
 [21.845985]
 [11.90316 ]
 [41.75515 ]
 [43.515163]]
10 Cost:  71.919495
Prediction:
 [[144.80006]
 [191.46127]
 [179.55899]
 [197.05446]
 [149.08711]
 [114.21464]
 [144.80202]
 [103.06957]
 [184.78198]
 [175.99176]]
```

```
.
.
.

100 Cost:  73.38932
Prediction:
 [[145.90152]
 [192.30104]
 [180.63896]
 [198.19327]
 [149.63803]
 [114.50667]
 [145.73486]
 [103.88781]
 [185.40894]
 [176.4467 ]]
```

```
Your score will be  [[222.69714]]
Other scores will be  [[169.29909]
 [163.73312]]
```

```python
import tensorflow as tf
filename_queue = tf.train.string_input_producer(
    ['g:\\data-01-test-score.csv'], shuffle=False,
     name='filename_queue')

reader = tf.TextLineReader()
key, value = reader.read(filename_queue)

# Default values, in case of empty columns.
# Also specifies the type of the decoded result.
record_defaults = [[0.], [0.], [0.], [0.]]
xy = tf.decode_csv(value, record_defaults=record_defaults)

# collect batches of csv in
train_x_batch, train_y_batch = \
    tf.train.batch([xy[0:-1], xy[-1:]], batch_size=10)

# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 3])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([3, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis
hypothesis = tf.matmul(X, W) + b

# Simplified cost/loss function
cost = tf.reduce_mean(tf.square(hypothesis - Y))


# Minimize
optimizer = tf.train.GradientDescentOptimizer(learning_rate=1e-5)
train = optimizer.minimize(cost)
```

```python
# Launch the graph in a session.
sess = tf.Session()
# Initializes global variables in the graph.
sess.run(tf.global_variables_initializer())

# Start populating the filename queue.
coord = tf.train.Coordinator()
threads = tf.train.start_queue_runners(sess=sess, coord=coord)
```

Print

Next slide

```python
coord.request_stop()
coord.join(threads)
# Ask my score
print("X: [[100, 70, 101] -> Your score will be ",
      sess.run(hypothesis, feed_dict={X: [[100, 70, 101]]}))

print("X: [[60, 70, 110], [90, 100, 80]] -> Other scores will be ",
      sess.run(hypothesis, feed_dict={X: [[60, 70, 110], [90, 100, 80]]}))
```

73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192

```
========== step : 0 ==========
x_batch
[[ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]
 [ 53.  46.  55.]
 [ 69.  74.  77.]
 [ 47.  56.  60.]
 [ 87.  79.  90.]
 [ 79.  70.  88.]]
y_batch
[[152.]
 [185.]
 [180.]
 [196.]
 [142.]
 [101.]
 [149.]
 [115.]
 [175.]
 [164.]]
0 Cost:  15626.736
Prediction:
 [[33.822662]
 [33.227776]
 [36.44336 ]
 [43.341988]
 [20.089188]
 [18.80383 ]
 [39.361553]
 [39.253216]
 [33.390327]
 [37.8106  ]]
```

```
========== step : 1 ==========
x_batch
[[69. 70. 73.]
 [70. 65. 74.]
 [93. 95. 91.]
 [79. 80. 73.]
 [70. 73. 78.]
 [93. 89. 96.]
 [78. 75. 68.]
 [81. 90. 93.]
 [88. 92. 86.]
 [78. 83. 77.]]
y_batch
[[141.]
 [141.]
 [184.]
 [152.]
 [148.]
 [192.]
 [147.]
 [183.]
 [177.]
 [159.]]
1 Cost:  6966.9272
Prediction:
 [[ 73.37271]
 [ 70.24524]
 [ 88.44955]
 [ 67.67078]
 [ 81.97356]
 [ 92.13124]
 [ 57.6976 ]
 [103.21454]
 [ 84.87416]
 [ 77.22461]]
```

```
========== step : 2 ==========
x_batch
[[ 82.  86.  90.]
 [ 86.  82.  89.]
 [ 78.  83.  85.]
 [ 76.  83.  71.]
 [ 96.  93.  95.]
 [ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]]
y_batch
[[177.]
 [175.]
 [175.]
 [149.]
 [192.]
 [152.]
 [185.]
 [180.]
 [196.]
 [142.]]
2 Cost:  2882.1062
Prediction:
 [[129.36467]
 [119.89173]
 [122.91422]
 [101.43338]
 [127.88004]
 [109.11273]
 [123.7469 ]
 [125.61891]
 [140.46437]
 [ 89.12875]]
```

```
========== step : 3 ==========
x_batch
[[53. 46. 55.]
 [69. 74. 77.]
 [47. 56. 60.]
 [87. 79. 90.]
 [79. 70. 88.]
 [69. 70. 73.]
 [70. 65. 74.]
 [93. 95. 91.]
 [79. 80. 73.]
 [70. 73. 78.]]
y_batch
[[101.]
 [149.]
 [115.]
 [175.]
 [164.]
 [141.]
 [141.]
 [184.]
 [152.]
 [148.]]
3 Cost:  569.48157
Prediction:
 [[ 83.78645 ]
 [132.1648  ]
 [108.04447 ]
 [141.39131 ]
 [137.85143 ]
 [121.363716]
 [117.552574]
 [151.6006  ]
 [120.1795  ]
 [132.00679 ]]
```

```
73,80,75,152
93,88,93,185
89,91,90,180
96,98,100,196
73,66,70,142
53,46,55,101
69,74,77,149
47,56,60,115
87,79,90,175
79,70,88,164
69,70,73,141
70,65,74,141
93,95,91,184
79,80,73,152
70,73,78,148
93,89,96,192
78,75,68,147
81,90,93,183
88,92,86,177
78,83,77,159
82,86,90,177
86,82,89,175
78,83,85,175
76,83,71,149
96,93,95,192
```

```
========== step : 4 ==========
x_batch
[[93. 89. 96.]
 [78. 75. 68.]
 [81. 90. 93.]
 [88. 92. 86.]
 [78. 83. 77.]
 [82. 86. 90.]
 [86. 82. 89.]
 [78. 83. 85.]
 [76. 83. 71.]
 [96. 93. 95.]]
y_batch
[[192.]
 [147.]
 [183.]
 [177.]
 [159.]
 [177.]
 [175.]
 [175.]
 [149.]
 [192.]]
4 Cost:  515.2943
Prediction:
 [[164.57298]
 [115.26143]
 [172.02415]
 [154.17735]
 [139.23433]
 [161.77357]
 [152.17473]
 [153.813  ]
 [130.29564]
 [163.54369]]
```

```
========== step : 99 ==========
x_batch
[[93. 89. 96.]
 [78. 75. 68.]
 [81. 90. 93.]
 [88. 92. 86.]
 [78. 83. 77.]
 [82. 86. 90.]
 [86. 82. 89.]
 [78. 83. 85.]
 [76. 83. 71.]
 [96. 93. 95.]]
y_batch
[[192.]
 [147.]
 [183.]
 [177.]
 [159.]
 [177.]
 [175.]
 [175.]
 [149.]
 [192.]]
99 Cost:  40.23986
Prediction:
 [[186.25519]
 [132.75537]
 [192.32066]
 [174.96257]
 [157.80383]
 [181.72513]
 [172.2168 ]
 [172.84021]
 [148.3078 ]
 [185.77002]]
```

```
========== step : 100 ==========
x_batch
[[ 73.  80.  75.]
 [ 93.  88.  93.]
 [ 89.  91.  90.]
 [ 96.  98. 100.]
 [ 73.  66.  70.]
 [ 53.  46.  55.]
 [ 69.  74.  77.]
 [ 47.  56.  60.]
 [ 87.  79.  90.]
 [ 79.  70.  88.]]
y_batch
[[152.]
 [185.]
 [180.]
 [196.]
 [142.]
 [101.]
 [149.]
 [115.]
 [175.]
 [164.]]
100 Cost:  37.926846
Prediction:
 [[156.2176 ]
 [180.52586]
 [181.48537]
 [201.24272]
 [132.52562]
 [101.62663]
 [157.41142]
 [126.56079]
 [171.0205 ]
 [165.17174]]
```

X: [[100, 70, 101]] -> Your score will be [[183.92894]]
X: [[60, 70, 110], [90, 100, 80]] -> Other scores will be
[[192.63106]
[173.11311]]

Generate text data

```
f = open("e:/sample.txt", 'w')
name = input("파일 생성자는 누구입니까?  " )
data1 = "파일 생성자 :  " + name  + "\n"
f.write(data1)

for i in range(1, 11):
    data2 = "%d번째 라인 출력입니다.\n" % i
    f.write(data2)

data3 = "파일 쓰기를 마칩니다 . \n"
f.write(data3)
f.close()
```

생성된 sample.txt 내용

```
파일 생성자 :  Kim
1번째 라인 출력입니다.
2번째 라인 출력입니다.
3번째 라인 출력입니다.
4번째 라인 출력입니다.
5번째 라인 출력입니다.
6번째 라인 출력입니다.
7번째 라인 출력입니다.
8번째 라인 출력입니다.
9번째 라인 출력입니다.
10번째 라인 출력입니다.
파일 쓰기를 마칩니다.
```

Add text data

```
f = open ("e:/sample.txt", 'a')
for i in range(11, 20):
    data = "%d번째 줄입니다.\n" % i
    f.write(data)
f.close()
```

갱신된 sample.txt 내용

파일 생성자 : Kim
1번째 라인 출력입니다.
2번째 라인 출력입니다.
3번째 라인 출력입니다.
4번째 라인 출력입니다.
5번째 라인 출력입니다.
6번째 라인 출력입니다.
7번째 라인 출력입니다.
8번째 라인 출력입니다.
9번째 라인 출력입니다.
10번째 라인 출력입니다.
파일 쓰기를 마칩니다.
11번째 줄입니다.
12번째 줄입니다.
13번째 줄입니다.
14번째 줄입니다.
15번째 줄입니다.
16번째 줄입니다.
17번째 줄입니다.
18번째 줄입니다.
19번째 줄입니다.

Read text data

```
f = open("e:/ex.txt", 'r')
while True:
    line = f.readline()
    if not line: break
    print(line, end="")
f.close()
```

ex.txt 내용

All is well that end is well.
Bad news travels fast.
Well begun is half done.
Birds of a feather flock together.

```
>>>
All is well that end is well.
Bad news travels fast.
Well begun is half done.
Birds of a feather flock together.
```

참고

f.read()

```
f = open("e:/ex.txt", 'r')
print(f.read())
f.close()
```

Example

파일에서 중복되지 않은 단어의 개수?

- 텍스트 파일을 읽어서 단어를 얼마나 다양하게 사용하여 문서를 작성하였는지를 계산하는 프로그램을 작성해보자.

ex.txt 내용

All is well that end is well.
Bad news travels fast.
Well begun is half done.
Birds of a feather flock together.

참고

split()메소드
스페이스바를 기준으로 데이터를 분리하여 리스트를 생성

split(“,”)메소드
콤마를 기준으로 데이터를 분리하여 리스트를 생성

```
>>>
입력할 파일의 경로 및 파일명 : e:\ex.txt
==============================================
line 출력 :  All is well that end is well.
line.split() 후 출력 :  ['All', 'is', 'well', 'that', 'end', 'is', 'well.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  All
line.split()의 내용을 for 문에서 한 단어씩 출력 :  is
line.split()의 내용을 for 문에서 한 단어씩 출력 :  well
line.split()의 내용을 for 문에서 한 단어씩 출력 :  that
line.split()의 내용을 for 문에서 한 단어씩 출력 :  end
line.split()의 내용을 for 문에서 한 단어씩 출력 :  is
line.split()의 내용을 for 문에서 한 단어씩 출력 :  well.
==============================================
line 출력 :  Bad news travels fast.
line.split() 후 출력 :  ['Bad', 'news', 'travels', 'fast.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  Bad
line.split()의 내용을 for 문에서 한 단어씩 출력 :  news
line.split()의 내용을 for 문에서 한 단어씩 출력 :  travels
line.split()의 내용을 for 문에서 한 단어씩 출력 :  fast.
==============================================
line 출력 :  Well begun is half done.
line.split() 후 출력 :  ['Well', 'begun', 'is', 'half', 'done.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  Well
line.split()의 내용을 for 문에서 한 단어씩 출력 :  begun
line.split()의 내용을 for 문에서 한 단어씩 출력 :  is
line.split()의 내용을 for 문에서 한 단어씩 출력 :  half
line.split()의 내용을 for 문에서 한 단어씩 출력 :  done.
==============================================
line 출력 :  Birds of a feather flock together.
line.split() 후 출력 :  ['Birds', 'of', 'a', 'feather', 'flock', 'together.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  Birds
line.split()의 내용을 for 문에서 한 단어씩 출력 :  of
line.split()의 내용을 for 문에서 한 단어씩 출력 :  a
line.split()의 내용을 for 문에서 한 단어씩 출력 :  feather
line.split()의 내용을 for 문에서 한 단어씩 출력 :  flock
line.split()의 내용을 for 문에서 한 단어씩 출력 :  together.

사용된 단어의 개수= 18
사용된 단어가 저장된 집합 출력 :  {'of', 'that', 'half', 'flock', 'begun',
'bad', 'a', 'end', 'well', 'fast', 'together', 'travels', 'done', 'all',
'birds', 'news', 'feather', 'is'}
```

Example solution

```
def process(w):
        output =""
        for ch in w:
                if( ch.isalpha() ):
                        output += ch
        return output.lower()
words = set() # set
# file open
fname = input("입력할 파일의 경로 및 파일명 : ")
file = open(fname, "r")

for line in file:  # for ~ in 에서는 line 단위로 읽음
      print("="*30)
      print("line 출력 : ", line , end="")
      lineWords = line.split() # list에 할당
      print("line.split() 후 출력 : ", lineWords)

      for word in lineWords: # for ~ in에서 ,를 기준으로 읽음
         print("line.split()의 내용을 for 문에서 한 단어씩 출력 : ", word)
         words.add(process(word)) #단어를 set에 추가
print("\n사용된 단어의 개수=", len(words))
print("사용된 단어가 저장된 집합 출력 : ", words)
```

```
>>>
입력할 파일의 경로 및 파일명 : e:\ex.txt
==============================
line 출력 :  All is well that end is well.
line.split() 후 출력 :  ['All', 'is', 'well', 'that', 'end', 'is', 'well.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  All
line.split()의 내용을 for 문에서 한 단어씩 출력 :  is
line.split()의 내용을 for 문에서 한 단어씩 출력 :  well
line.split()의 내용을 for 문에서 한 단어씩 출력 :  that
line.split()의 내용을 for 문에서 한 단어씩 출력 :  end
line.split()의 내용을 for 문에서 한 단어씩 출력 :  is
line.split()의 내용을 for 문에서 한 단어씩 출력 :  well.
==============================
line 출력 :  Bad news travels fast.
line.split() 후 출력 :  ['Bad', 'news', 'travels', 'fast.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  Bad
line.split()의 내용을 for 문에서 한 단어씩 출력 :  news
line.split()의 내용을 for 문에서 한 단어씩 출력 :  travels
line.split()의 내용을 for 문에서 한 단어씩 출력 :  fast.
==============================
line 출력 :  Well begun is half done.
line.split() 후 출력 :  ['Well', 'begun', 'is', 'half', 'done.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  Well
line.split()의 내용을 for 문에서 한 단어씩 출력 :  begun
line.split()의 내용을 for 문에서 한 단어씩 출력 :  is
line.split()의 내용을 for 문에서 한 단어씩 출력 :  half
line.split()의 내용을 for 문에서 한 단어씩 출력 :  done.
==============================
line 출력 :  Birds of a feather flock together.
line.split() 후 출력 :  ['Birds', 'of', 'a', 'feather', 'flock', 'together.']
line.split()의 내용을 for 문에서 한 단어씩 출력 :  Birds
line.split()의 내용을 for 문에서 한 단어씩 출력 :  of
line.split()의 내용을 for 문에서 한 단어씩 출력 :  a
line.split()의 내용을 for 문에서 한 단어씩 출력 :  feather
line.split()의 내용을 for 문에서 한 단어씩 출력 :  flock
line.split()의 내용을 for 문에서 한 단어씩 출력 :  together.

사용된 단어의 개수= 18
사용된 단어가 저장된 집합 출력 :  {'of', 'that', 'half', 'flock', 'begun', 'bad', 'a', 'end', 'well', 'fast', 'together', 'travels', 'done', 'all', 'birds', 'news', 'feather', 'is'}
```