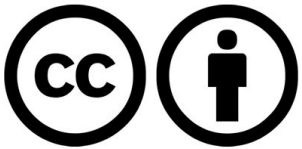
With TF 1.0!

Lab 5

Logistic (regression) classifier

Sung Kim <hunkim+ml@gmail.com>

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



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

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

With TF 1.0!

Lab 5

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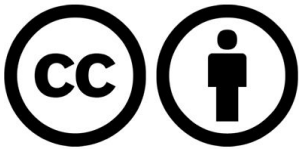
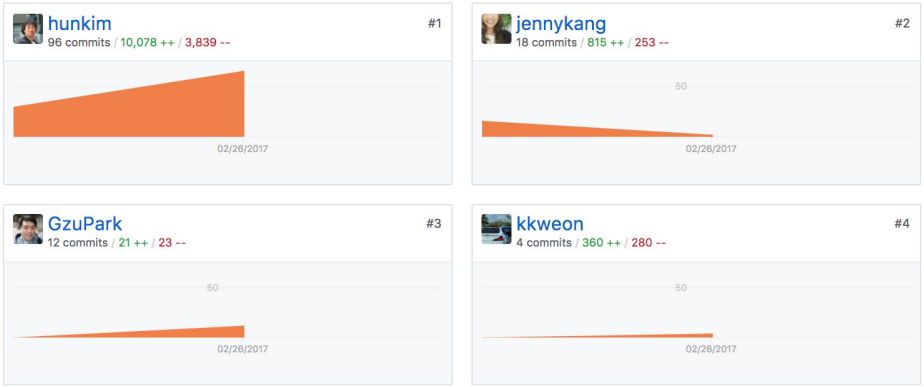
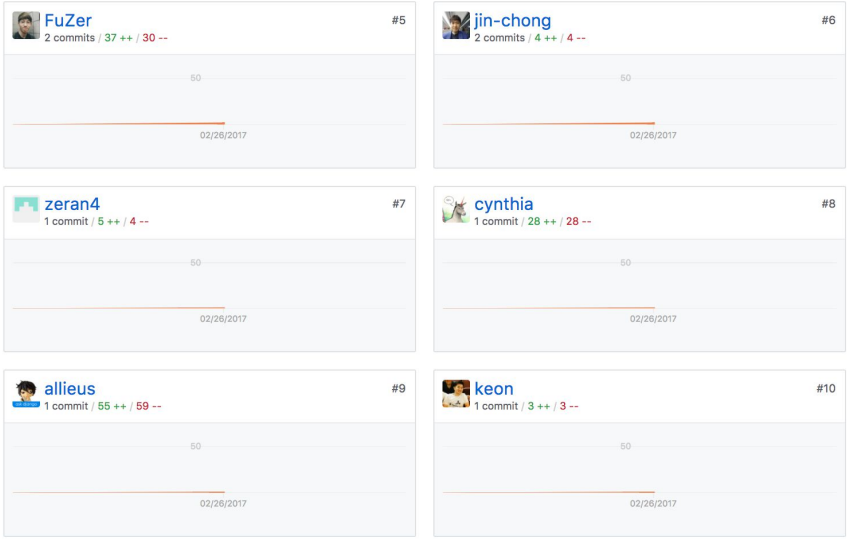
Code: https://github.com/hunkim/DeepLearningZeroToAll/



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





Logistic Regression

$$H(X) = \frac{1}{1 + e^{-W^T X}}$$

$$cost(W) = -\frac{1}{m} \sum y log(H(x)) + (1 - y)(log(1 - H(x))$$

$$W := W - \alpha \frac{\partial}{\partial W} cost(W)$$

Training Data

```
x_data = [[1, 2], [2, 3], [3, 1], [4, 3], [5, 3], [6, 2]]
y_data = [[0], [0], [0], [1], [1], [1]]

# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 2])
Y = tf.placeholder(tf.float32, shape=[None, 1])
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-05-1-logistic_regression.py

```
X = tf.placeholder(tf.float32, shape=[None, 2])
Y = tf.placeholder(tf.float32, shape=[None, 1])
W = tf.Variable(tf.random_normal([2, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')


# Hypothesis using sigmoid: tf.div(1., 1. + tf.exp(tf.matmul(X, W) + b))
hypothesis = tf.sigmoid(tf.matmul(X, W) + b)
```

$$H(X) = \frac{1}{1 + e^{-W^T X}}$$

$$cost(W) = -\frac{1}{m} \sum ylog(H(x)) + (1 - y)(log(1 - H(x))$$

```
# cost/loss function
cost = -tf.reduce_mean(Y * tf.log(hypothesis) + (1 - Y) *
                       tf.log(1 - hypothesis))


train = tf.train.GradientDescentOptimizer(learning_rate=0.01).minimize(cost)
```

$$W := W - \alpha \frac{\partial}{\partial W} cost(W)$$

```
# Accuracy computation
# True if hypothesis>0.5 else False
predicted = tf.cast(hypothesis > 0.5, dtype=tf.float32)
accuracy = tf.reduce_mean(tf.cast(tf.equal(predicted, Y), dtype=tf.float32))
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-05-1-logistic_regression.py

Train the model

```
# Launch graph
with tf.Session() as sess:
    # Initialize TensorFlow variables
    sess.run(tf.global_variables_initializer())

    for step in range(10001):
        cost_val, _ = sess.run([cost, train], feed_dict={X: x_data, Y: y_data})
        if step % 200 == 0:
            print(step, cost_val)

    # Accuracy report
    h, c, a = sess.run([hypothesis, predicted, accuracy],
                       feed_dict={X: x_data, Y: y_data})
    print("\nHypothesis: ", h, "\nCorrect (Y): ", c, "\nAccuracy: ", a)
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-05-1-logistic_regression.py

```python
x_data = [[1, 2], [2, 3], [3, 1], [4, 3], [5, 3], [6, 2]]
y_data = [[0], [0], [0], [1], [1], [1]]
# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 2])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([2, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')
# Hypothesis using sigmoid: tf.div(1., 1. + tf.exp(tf.matmul(X, W)))
hypothesis = tf.sigmoid(tf.matmul(X, W) + b)
# cost/loss function
cost = -tf.reduce_mean(Y * tf.log(hypothesis) + (1 - Y) * tf.log(1 - hypothesis))
train = tf.train.GradientDescentOptimizer(learning_rate=0.01).minimize(cost)

# Accuracy computation
# True if hypothesis>0.5 else False
predicted = tf.cast(hypothesis > 0.5, dtype=tf.float32)
accuracy = tf.reduce_mean(tf.cast(tf.equal(predicted, Y), dtype=tf.float32))

# Launch graph
with tf.Session() as sess:
    # Initialize TensorFlow variables
    sess.run(tf.global_variables_initializer())

    for step in range(10001):
        cost_val, _ = sess.run([cost, train], feed_dict={X: x_data, Y: y_data})
        if step % 200 == 0:
            print(step, cost_val)

    # Accuracy report
    h, c, a = sess.run([hypothesis, predicted, accuracy],
                       feed_dict={X: x_data, Y: y_data})
    print("\nHypothesis: ", h, "\nCorrect (Y): ", c, "\nAccuracy: ", a)
```

```
# step, cost
0 1.73078
200 0.571512
400 0.507414
...
9600 0.154132
9800 0.151778
10000 0.149496


Hypothesis:
[[ 0.03074029]
 [ 0.15884677]
 [ 0.30486736]
 [ 0.78138196]
 [ 0.93957496]
 [ 0.98016882]]

Correct (Y):
[[ 0.]
 [ 0.]
 [ 0.]
 [ 1.]
 [ 1.]
 [ 1.]]

Accuracy:  1.0
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-05-1-logistic_regression.py

Classifying diabetes

-0.411765	0.165829	0.213115	0	0	-0.23696	-0.894962	-0.7	1
-0.647059	-0.21608	-0.180328	-0.353535	-0.791962	-0.0760059	-0.854825	-0.833333	0
0.176471	0.155779	0	0	0	0.052161	-0.952178	-0.733333	1
-0.764706	0.979899	0.147541	-0.0909091	0.283688	-0.0909091	-0.931682	0.0666667	0
-0.0588235	0.256281	0.57377	0	0	0	-0.868488	0.1	0
-0.529412	0.105528	0.508197	0	0	0.120715	-0.903501	-0.7	1
0.176471	0.688442	0.213115	0	0	0.132638	-0.608027	-0.566667	0
0.176471	0.396985	0.311475	0	0	-0.19225	0.163962	0.2	1

```
xy = np.loadtxt('data-03-diabetes.csv', delimiter=',', dtype=np.float32)
x_data = xy[:, 0:-1]
y_data = xy[:, [-1]]
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-05-2-logistic_regression_diabetes.py

```python
xy = np.loadtxt('data-03-diabetes.csv', delimiter=',', dtype=np.float32)
x_data = xy[:, 0:-1]
y_data = xy[:, [-1]]

# placeholders for a tensor that will be always fed.
X = tf.placeholder(tf.float32, shape=[None, 8])
Y = tf.placeholder(tf.float32, shape=[None, 1])

W = tf.Variable(tf.random_normal([8, 1]), name='weight')
b = tf.Variable(tf.random_normal([1]), name='bias')

# Hypothesis using sigmoid: tf.div(1., 1. + tf.exp(tf.matmul(X, W)))
hypothesis = tf.sigmoid(tf.matmul(X, W) + b)
# cost/loss function
cost = -tf.reduce_mean(Y * tf.log(hypothesis) + (1 - Y) * tf.log(1 - hypothesis))
train = tf.train.GradientDescentOptimizer(learning_rate=0.01).minimize(cost)

# Accuracy computation
# True if hypothesis>0.5 else False
predicted = tf.cast(hypothesis > 0.5, dtype=tf.float32)
accuracy = tf.reduce_mean(tf.cast(tf.equal(predicted, Y), dtype=tf.float32))

# Launch graph
with tf.Session() as sess:
    sess.run(tf.global_variables_initializer())

    feed = {X: x_data, Y: y_data}
    for step in range(10001):
        sess.run(train, feed_dict=feed)
        if step % 200 == 0:
            print(step, sess.run(cost, feed_dict=feed))

    # Accuracy report
    h, c, a = sess.run([hypothesis, predicted, accuracy], feed_dict=feed)
    print("\nHypothesis: ", h, "\nCorrect (Y): ", c, "\nAccuracy: ", a)
```

```
0 0.82794
200 0.755181
400 0.726355
600 0.705179
800 0.686631
...
9600 0.492056
9800 0.491396
10000 0.490767


 [ 0.7461012 ]
 [ 0.79919308]
 [ 0.72995949]
 [ 0.88297188]]

[ 1.]
[ 1.]
[ 1.]]
Accuracy:
0.762846
```

https://github.com/hunkim/DeepLearningZeroToAll/blob/master/lab-05-2-logistic_regression_diabetes.py

Exercise

- CSV reading using *tf.decode_csv*
- Try other classification data from Kaggle
  - https://www.kaggle.com

Lab 6

Softmax classifier

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