tensorflow_examples_from_video

December 13, 2020

1 Video "What is TensorFlow"

```
In [1]: %config IPCompleter.greedy=True
```

```
In [2]: import tensorflow as tf
        import numpy as np
        print(tf.__version__)
```

```
1.2.1
```

```
In [3]: tf.reset_default_graph()
        a = tf.placeholder(np.float32, (2, 2))
        b = tf.Variable(tf.ones((2, 2)))
        c = a @ b
```

```
In [4]: print(c)
```

```
Tensor("matmul:0", shape=(2, 2), dtype=float32)
```

```
In [5]: s = tf.InteractiveSession()
```

```
In [6]: s.run(tf.global_variables_initializer())
        s.run(c, feed_dict={a: np.ones((2, 2))})
```

```
Out[6]: array([[ 2.,  2.],
               [ 2.,  2.]], dtype=float32)
```

```
In [7]: s.close()
```

2 Video "Our first model in TensorFlow"

2.0.1 Simple optimization (with simple prints)

```
In [8]: tf.reset_default_graph()
        x = tf.get_variable("x", shape=(), dtype=tf.float32, trainable=True)
        f = x ** 2
```

```
In [9]: optimizer = tf.train.GradientDescentOptimizer(0.1)
        step = optimizer.minimize(f, var_list=[x])

In [10]: tf.trainable_variables()

Out[10]: [<tf.Variable 'x:0' shape=() dtype=float32_ref>]

In [11]: with tf.Session() as s:  # in this way session will be closed automatically
             s.run(tf.global_variables_initializer())
             for i in range(10):
                 _, curr_x, curr_f = s.run([step, x, f])
                 print(curr_x, curr_f)
```

```
-1.15466 2.08319
-0.923728 1.33324
-0.738982 0.853273
-0.591186 0.546095
-0.472949 0.349501
-0.378359 0.22368
-0.302687 0.143155
-0.24215 0.0916195
-0.19372 0.0586365
-0.154976 0.0375273
```

2.0.2 Simple optimization (with tf.Print)

```
In [13]: tf.reset_default_graph()
         x = tf.get_variable("x", shape=(), dtype=tf.float32)
         f = x ** 2
         f = tf.Print(f, [x, f], "x, f:")

In [14]: optimizer = tf.train.GradientDescentOptimizer(0.1)
         step = optimizer.minimize(f)

In [15]: with tf.Session() as s:
             s.run(tf.global_variables_initializer())
             for i in range(10):
                 s.run([step, f])

In [15]: # Prints to jupyter server stdout (not available in Coursera Notebooks):
         # 2018-07-21 18:01:27.308270: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-1.067
         # 2018-07-21 18:01:27.308809: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.853
         # 2018-07-21 18:01:27.309116: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.682
         # 2018-07-21 18:01:27.309388: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.546
         # 2018-07-21 18:01:27.309678: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.437
         # 2018-07-21 18:01:27.309889: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.349
         # 2018-07-21 18:01:27.310213: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.279
         # 2018-07-21 18:01:27.310475: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.223
         # 2018-07-21 18:01:27.310751: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.179
         # 2018-07-21 18:01:27.310963: I tensorflow/core/kernels/logging_ops.cc:79] x, f:[-0.143
```

2.0.3 Simple optimization (with TensorBoard logging)

In [16]:
```
tf.reset_default_graph()
x = tf.get_variable("x", shape=(), dtype=tf.float32)
f = x ** 2
```

In [17]:
```
optimizer = tf.train.GradientDescentOptimizer(0.1)
step = optimizer.minimize(f)
```

In [18]:
```
tf.summary.scalar('curr_x', x)
tf.summary.scalar('curr_f', f)
summaries = tf.summary.merge_all()
```

In [19]:
```
s = tf.InteractiveSession()
summary_writer = tf.summary.FileWriter("logs/1", s.graph)
s.run(tf.global_variables_initializer())
for i in range(10):
    _, curr_summaries = s.run([step, summaries])
    summary_writer.add_summary(curr_summaries, i)
    summary_writer.flush()
```

Run `tensorboard --logdir=./logs` in bash
This is what you can see in your browser **(not available in Coursera Notebooks)**
If you're running on Google Colab you can still run TensorBoard!

In [ ]:
```
# !!! RUN THIS CELL ONLY ON GOOGLE COLAB !!!
! wget https://raw.githubusercontent.com/hse-aml/intro-to-dl/master/setup_google_colab.p
import setup_google_colab

# run tensorboard in background
import os
os.system("tensorboard --logdir=./logs --host 0.0.0.0 --port 6006 &")

# expose port and show the link
setup_google_colab.expose_port_on_colab(6006)
```

In [20]:
```
s.close()
```

2.0.4 Training a linear model

In [21]:
```
# generate model data
N = 1000
D = 3
x = np.random.random((N, D))
w = np.random.random((D, 1))
y = x @ w + np.random.randn(N, 1) * 0.20

print(x.shape, y.shape)
print(w.T)
```

```
(1000, 3) (1000, 1)
[[ 0.46368131  0.55221746  0.50051695]]
```

```
In [22]: tf.reset_default_graph()

         features = tf.placeholder(tf.float32, shape=(None, D))
         target = tf.placeholder(tf.float32, shape=(None, 1))

         weights = tf.get_variable("weights", shape=(D, 1), dtype=tf.float32)
         predictions = features @ weights

         loss = tf.reduce_mean((target - predictions) ** 2)

         print(target.shape, predictions.shape, loss.shape)
```

```
(?, 1) (?, 1) ()
```

```
In [24]: optimizer = tf.train.GradientDescentOptimizer(0.1)
         step = optimizer.minimize(loss)
```

```
In [25]: with tf.Session() as s:
             s.run(tf.global_variables_initializer())
             for i in range(300):
                 _, curr_loss, curr_weights = s.run([step, loss, weights],
                                                    feed_dict={features: x, target: y})
                 if i % 50 == 0:
                     print(curr_loss)
```

```
1.45325
0.042995
0.0389059
0.0381101
0.0379536
0.0379225
```

```
In [26]: # found weights
         curr_weights.T
```

```
Out[26]: array([[ 0.44154644,  0.54716033,  0.52464718]], dtype=float32)
```

```
In [27]: # true weights
         w.T
```

```
Out[27]: array([[ 0.46368131,  0.55221746,  0.50051695]])
```