TensorFlow

前向传播（张量）实战

主讲：龙良曲

What we have learned

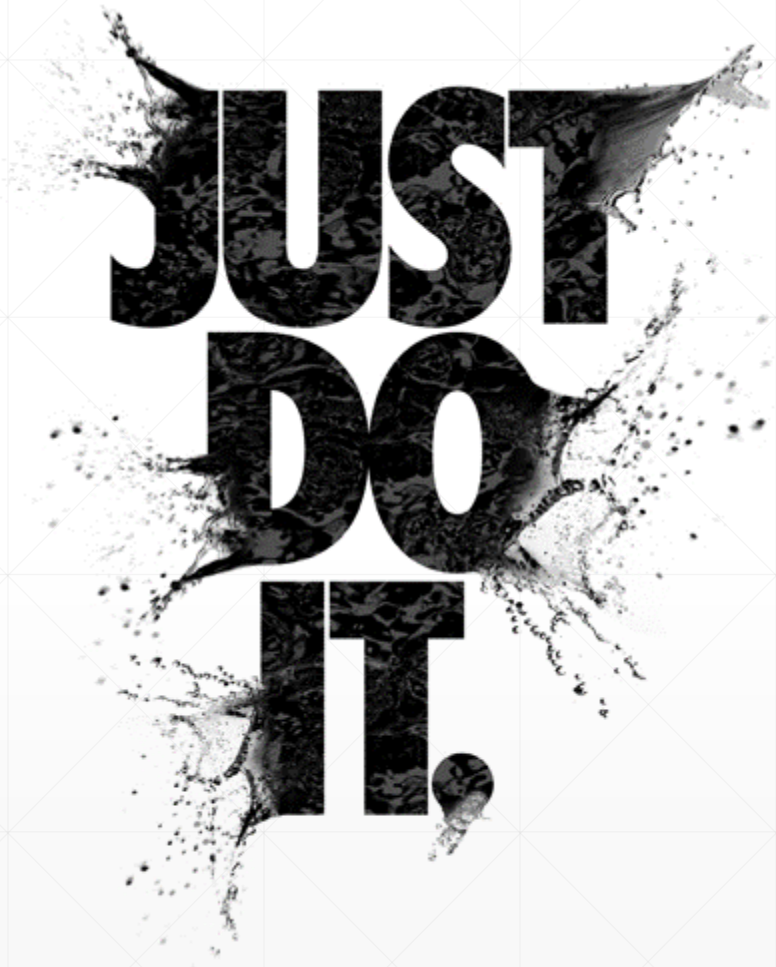
- create tensor
- indexing and slices
- reshape and broadcasting
- math operations

Recap

- $out = relu\{relu\{relu[X@W_1 + b_1]@W_2 + b_2\}@W_3 + b_3\}$

- $pred = argmax(out)$
- $loss = MSE(out, label)$

- minimize $loss$
  - $[W_1', b_1', W_2', b_2', W_3', b_3']$


JUST
DO
IT.

$$relu[X@W_1 + b_1]$$

```
    # 784 => 512
    w1, b1 = tf.Variable(tf.random.truncated_normal([784, 512], stddev=0.1)),
tf.Variable(tf.zeros([512]))

    for step, (x,y) in enumerate(train_db):
        # [b, 28, 28] => [b, 784]
        x = tf.reshape(x, (-1, 784))
        with tf.GradientTape() as tape:

            # layer1.
            h1 = x @ w1 + b1
            h1 = tf.nn.relu(h1)
```

$$\{relu\{relu[X@W_1 + b_1]@W_2 + b_2\}$$

```
    # 784 => 512
    w1, b1 = tf.Variable(tf.random.truncated_normal([784, 512], stddev=0.1)),
tf.Variable(tf.zeros([512]))
    # 512 => 256
    w2, b2 = tf.Variable(tf.random.truncated_normal([512, 256], stddev=0.1)),
tf.Variable(tf.zeros([256]))

    for step, (x,y) in enumerate(train_db):
        # [b, 28, 28] => [b, 784]
        x = tf.reshape(x, (-1, 784))
        with tf.GradientTape() as tape:

            # layer1.
            h1 = x @ w1 + b1
            h1 = tf.nn.relu(h1)
            # layer2
            h2 = h1 @ w2 + b2
            h2 = tf.nn.relu(h2)
```

$$out = relu\{relu\{relu[X@W_1 + b_1]@W_2 + b_2\}@W_3 + b_3\}$$

```
    # 784 => 512
    w1, b1 = tf.Variable(tf.random.truncated_normal([784, 512], stddev=0.1)),
tf.Variable(tf.zeros([512]))
    # 512 => 256
    w2, b2 = tf.Variable(tf.random.truncated_normal([512, 256], stddev=0.1)),
tf.Variable(tf.zeros([256]))
    # 256 => 10
    w3, b3 = tf.Variable(tf.random.truncated_normal([256, 10], stddev=0.1)),
tf.Variable(tf.zeros([10]))
    for step, (x,y) in enumerate(train_db):
        # [b, 28, 28] => [b, 784]
        x = tf.reshape(x, (-1, 784))
        with tf.GradientTape() as tape:

            # layer1.
            h1 = x @ w1 + b1
            h1 = tf.nn.relu(h1)
            # layer2
            h2 = h1 @ w2 + b2
            h2 = tf.nn.relu(h2)
            # output
            out = h2 @ w3 + b3
```

Compute loss

```
# compute loss
# [b, 10] - [b, 10]
loss = tf.square(y-out)
# [b, 10] => [b]
loss = tf.reduce_mean(loss, axis=1)
# [b] => scalar
loss = tf.reduce_mean(loss)
```

Compute gradient and update w

```
        # compute gradient
        grads = tape.gradient(loss, [w1, b1, w2, b2, w3, b3])
        # for g in grads:
        #     print(tf.norm(g))
        # update w' = w - lr*grad
        optimizer.apply_gradients(zip(grads, [w1, b1, w2, b2, w3, b3]))
```

下一课时

合并与切割

Thank You.