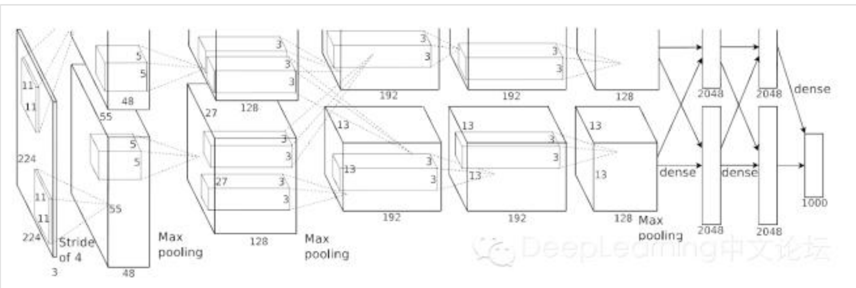
原 TensorFlow人工智能引擎入门教程之三 实现一个自创的CNN卷积神经网络

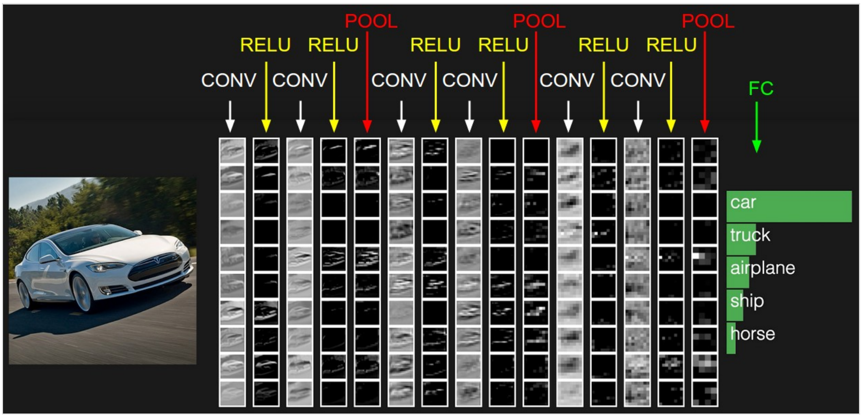
首先回到上一张的google官方的alexnet文件

这是alexnet网络定义的部分 ，我们只需要修改这一部就可以了

```
def alex_net(_X, _weights, _biases, _dropout):    # Reshape input picture    _X = tf.reshape(_X, shape=
[-1, 28, 28, 1])    # Convolution Layer    conv1 = conv2d('conv1', _X, _weights['wc1'], _biases['bc1'])
    # Max Pooling (down-sampling)    pool1 = max_pool('pool1', conv1, k=2)    # Apply Normalization
    norm1 = norm('norm1', pool1, lsize=4)    # Apply Dropout    norm1 = tf.nn.dropout(norm1, _dropo
ut)    # Convolution Layer    conv2 = conv2d('conv2', norm1, _weights['wc2'], _biases['bc2'])    # Max P
ooling (down-sampling)    pool2 = max_pool('pool2', conv2, k=2)    # Apply Normalization    norm
2 = norm('norm2', pool2, lsize=4)    # Apply Dropout    norm2 = tf.nn.dropout(norm2, _dropout)
    # Convolution Layer    conv3 = conv2d('conv3', norm2, _weights['wc3'], _biases['bc3'])    # Max Pool
ing (down-sampling)    pool3 = max_pool('pool3', conv3, k=2)    # Apply Normalization    norm3 = no
rm('norm3', pool3, lsize=4)    # Apply Dropout    norm3 = tf.nn.dropout(norm3, _dropout)    # Fully co
nnected layer    dense1 = tf.reshape(norm3, [-1, _weights['wd1'].get_shape().as_list()[0]]) # Reshape con
v3 output to fit dense layer input    dense1 = tf.nn.relu(tf.matmul(dense1, _weights['wd1']) + _biases['b
d1'], name='fc1') # Relu activation    dense2 = tf.nn.relu(tf.matmul(dense1, _weights['wd2']) + _biases['b
d2'], name='fc2') # Relu activation    # Output, class prediction    out = tf.matmul(dense2, _weights['ou
t']) + _biases['out']    return out # Store layers weight & bias weights = {    'wc1': tf.Variable(tf.rando
m_normal([3, 3, 1, 64])),    'wc2': tf.Variable(tf.random_normal([3, 3, 64, 128])),    'wc3': tf.Variable(tf.ran
dom_normal([3, 3, 128, 256])),    'wd1': tf.Variable(tf.random_normal([4*4*256, 1024])),    'wd2': tf.Varia
ble(tf.random_normal([1024, 1024])),    'out': tf.Variable(tf.random_normal([1024, 10])) } biases = {    'bc
1': tf.Variable(tf.random_normal([64])),    'bc2': tf.Variable(tf.random_normal([128])),    'bc3': tf.Variable(t
f.random_normal([256])),    'bd1': tf.Variable(tf.random_normal([1024])),    'bd2': tf.Variable(tf.random_n
ormal([1024])),    'out': tf.Variable(tf.random_normal([n_classes])) } # Construct model pred = alex_ne
t(x, weights, biases, keep_prob)
```

首选要理清他的网络图 这是alexnet论文的 图片 ，这里引用一下 ，每一层与上面对应





下面 我们 做一个实现 ，我们 给conv1 conv2 conv3 后面加上一个conv4 maxpool ，我们看看核心代码区域

Y=wx+b

```
 # Convolution Layer     conv1 = conv2d('conv1', _X, _weights['wc1'], _biases['bc1'])     # Max Pooling (d
own-sampling)     pool1 = max_pool('pool1', conv1, k=2)     # Apply Normalization     norm1 = norm('n
orm1', pool1, lsize=4)     # Apply Dropout     norm1 = tf.nn.dropout(norm1, _dropout)     # Convolutio
n Layer     conv2 = conv2d('conv2', norm1, _weights['wc2'], _biases['bc2'])     # Max Pooling (down-sam
pling)     pool2 = max_pool('pool2', conv2, k=2)     # Apply Normalization     norm2 = norm('norm2', po
ol2, lsize=4)     # Apply Dropout     norm2 = tf.nn.dropout(norm2, _dropout)     # Convolution Layer     c
onv3 = conv2d('conv3', norm2, _weights['wc3'], _biases['bc3'])     # Max Pooling (down-sampling)     po
ol3 = max_pool('pool3', conv3, k=2)     # Apply Normalization     norm3 = norm('norm3', pool3, lsize=4)
    # Apply Dropout     norm3 = tf.nn.dropout(norm3, _dropout)
```

我先往上面我们加上conv4一层

#这后面我们加上部分代码

```
    #convolution layer     conv4 = conv2d('conv4',norm3,tf.Variable(tf.random_normal([2, 2, 256, 512])),t
f.Variable(tf.random_normal([512]))     # Max Pooling (down-sampling)     pool4 = max_pool('pool4', co
nv4, k=2)     # Apply Normalization     norm4 = norm('norm4', pool4, lsize=4)     # Apply Dropout     nor
m4 = tf.nn.dropout(norm4, _dropout)
```

这样我们 我们加上一层conv2 以2 2的卷积核以及 512输出特征 2x2的pool .我们先不考虑 精度会不会提高的问题，我们只是自定义一个测试看看

根据上面的卷积一层一层 shape 运算 我们得到

最后一层计算（4-2）/2+1=2

也就是说输入为2*2*512

这样我们只需要修改w的矩阵格式 以及 b的矩阵格式即可了

```python
# Store layers weight & bias
weights = {
    'wc1': tf.Variable(tf.random_normal([3, 3, 1, 64])),
    'wc2': tf.Variable(tf.random_normal([3, 3, 64, 128])),
    'wc3': tf.Variable(tf.random_normal([3, 3, 128, 256])),
    'wc4': tf.Variable(tf.random_normal([2, 2, 256, 512])),
    'wd1': tf.Variable(tf.random_normal([2*2*512, 1024])),
    'wd2': tf.Variable(tf.random_normal([1024, 1024])),
    'out': tf.Variable(tf.random_normal([1024, 10]))
}
biases = {
    'bc1': tf.Variable(tf.random_normal([64])),
    'bc2': tf.Variable(tf.random_normal([128])),
    'bc3': tf.Variable(tf.random_normal([256])),
    'bc4': tf.Variable(tf.random_normal([512])),
    'bd1': tf.Variable(tf.random_normal([1024])),
    'bd2': tf.Variable(tf.random_normal([1024])),
    'out': tf.Variable(tf.random_normal([n_classes]))
}
```

这时候 我们成功在官方alexnet网络上加了一层

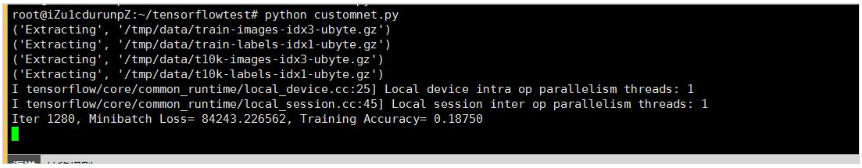
形成了 conv1--->conv2----->conv3---->conv4---->full---full---softmax分类 的一个自创的新网络

下面 贴出 修改后的alexnet的代码

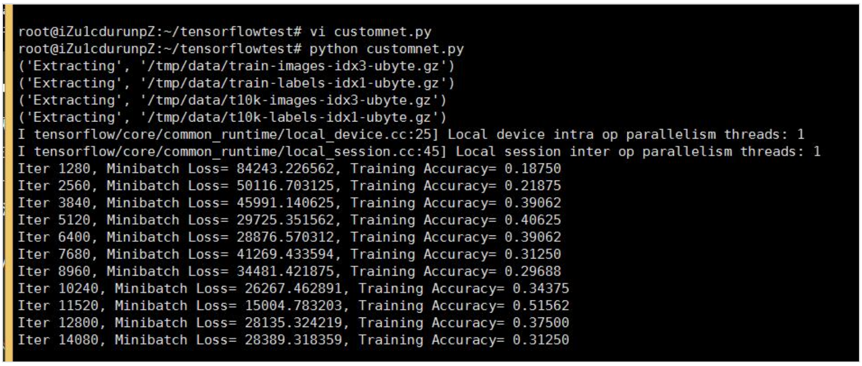
```
import input_data mnist = input_data.read_data_sets("/tmp/data/", one_hot=True) import tensorflow as tf # Parameters learning_rate = 0.001 training_iters = 200000 batch_size = 64 display_step = 20 # Network Parameters n_input = 784 # MNIST data input (img shape: 28*28) n_classes = 10 # MNIST total classes (0-9 digits) dropout = 0.8 # Dropout, probability to keep units # tf Graph input x = tf.placeholder(tf.float32, [None, n_input]) y = tf.placeholder(tf.float32, [None, n_classes]) keep_prob = tf.placeholder(tf.float32) # dropout (keep probability) # Create custom model def conv2d(name, l_input, w, b):     return tf.nn.relu(tf.nn.bias_add(tf.nn.conv2d(l_input, w, strides=[1, 1, 1, 1], padding='SAME'),b), name=name) def max_pool(name, l_input, k):     return tf.nn.max_pool(l_input, ksize=[1, k, k, 1], strides=[1, k, k, 1], padding='SAME', name=name) def norm(name, l_input, lsize=4):     return tf.nn.lrn(l_input, lsize, bias=1.0, alpha=0.001 / 9.0, beta=0.75, name=name) def customnet(_X, _weights, _biases, _dropout):     # Reshape input picture     _X = tf.reshape(_X, shape=[-1, 28, 28, 1])     # Convolution Layer     conv1 = conv2d('conv1', _X, _weights['wc1'], _biases['bc1'])     # Max Pooling (down-sampling)     pool1 = max_pool('pool1', conv1, k=2)     # Apply Normalization     norm1 = norm('norm1', pool1, lsize=4)     # Apply Dropout     norm1 = tf.nn.dropout(norm1, _dropout)     # Convolution Layer     conv2 = conv2d('conv2', norm1, _weights['wc2'], _biases['bc2'])     # Max Pooling (down-sampling)     pool2 = max_pool('pool2', conv2, k=2)     # Apply Normalization     norm2 = norm('norm2', pool2, lsize=4)     # Apply Dropout     norm2 = tf.nn.dropout(norm2, _dropout)     # Convolution Layer     conv3 = conv2d('conv3', norm2, _weights['wc3'], _biases['bc3'])     # Max Pooling (down-sampling)     pool3 = max_pool('pool3', conv3, k=2)     # Apply Normalization     norm3 = norm('norm3', pool3, lsize=4)     # Apply Dropout     norm3 = tf.nn.dropout(norm3, _dropout)     #conv4     conv4 = conv2d('conv4', norm3, _weights['wc4'], _biases['bc4'])     # Max Pooling (down-sampling)     pool4 = max_pool('pool4', conv4, k=2)     # Apply Normalization     norm4 = norm('norm4', pool4, lsize=4)     # Apply Dropout     norm4 = tf.nn.dropout(norm4, _dropout)     # Fully connected layer     dense1 = tf.reshape(norm4, [-1, _weights['wd1'].get_shape().as_list()[0]]) # Reshape conv3 output to fit dense layer input     dense1 = tf.nn.relu(tf.matmul(dense1, _weights['wd1']) + _biases['bd1'], name='fc1') # Relu activation     dense2 = tf.nn.relu(tf.matmul(dense1, _weights['wd2']) + _biases['bd2'], name='fc2') # Relu activation     # Output, class prediction     out = tf.matmul(dense2, _weights['out']) + _biases['out']     return out # Store layers weight & bias weights = {     'wc1': tf.Variable(tf.random_normal([3, 3, 1, 64])),     'wc2': tf.Variable(tf.random_normal([3, 3, 64, 128])),     'wc3': tf.Variable(tf.random_normal([3, 3, 128, 256])),     'wc4': tf.Variable(tf.random_normal([2, 2, 256, 512])),     'wd1': tf.Variable(tf.random_normal([2*2*512, 1024])),     'wd2': tf.Variable(tf.random_normal([1024, 1024])),     'out': tf.Variable(tf.random_normal([1024, 10])) } biases = {     'bc1': tf.Variable(tf.random_normal([64])),     'bc2': tf.Variable(tf.random_normal([128])),     'bc3': tf.Variable(tf.random_normal([256])),     'bc4': tf.Variable(tf.random_normal([512])),     'bd1': tf.Variable(tf.random_normal([1024])),     'bd2': tf.Variable(tf.random_normal([1024])),     'out': tf.Variable(tf.random_normal([n_classes])) } # Construct model pred = customnet(x, weights, biases, keep_prob) # Define loss and optimizer cost = tf.reduce_mean(tf.nn.softmax_cross_entropy_with_logits(pred, y)) optimizer = tf.train.AdamOptimizer(learning_rate=learning_rate).minimize(cost) # Evaluate model correct_pred = tf.equal(tf.argmax(pred,1), tf.argmax(y,1)) accuracy = tf.reduce_mean(tf.cast(correct_pred, tf.float32)) # Initializing the variables init = tf.initialize_all_variables() # Launch the graph with tf.Session() as sess:     sess.run(init)     step = 1     # Keep training until reach max iterations     while step * batch_size < training_iters:         batch_xs, batch_ys = mnist.train.next_batch(batch_size)         # Fit training using batch data         sess.run(optimizer, feed_dict={x: batch_xs, y: batch_ys, keep_prob: dropout})         if step % display_step == 0:             # Calculate batch accuracy             acc = sess.run(accuracy, feed_dict={x: batch_xs, y: batch_ys, keep_prob: 1.})             # Calculate batch loss             loss = sess.run(cost, feed_dict={x: batch_xs, y: batch_ys, keep_prob: 1.})             print "Iter " + str(step*batch_size) + ", Minibatch Loss= " + "{:.6f}".format(loss) + ", Training Accuracy= " + "{:.5f}".format(acc)         step += 1     print "Optimization Finished!"     # Calculate accuracy for 256 mnist test images     print "Testing Accuracy:", sess.run(accuracy, feed_dict={x: mnist.test.images[:256], y: mnist.test.labels[:256], keep_prob: 1.})
```

下面我们运行测试 我们的custom自定义net网络吧

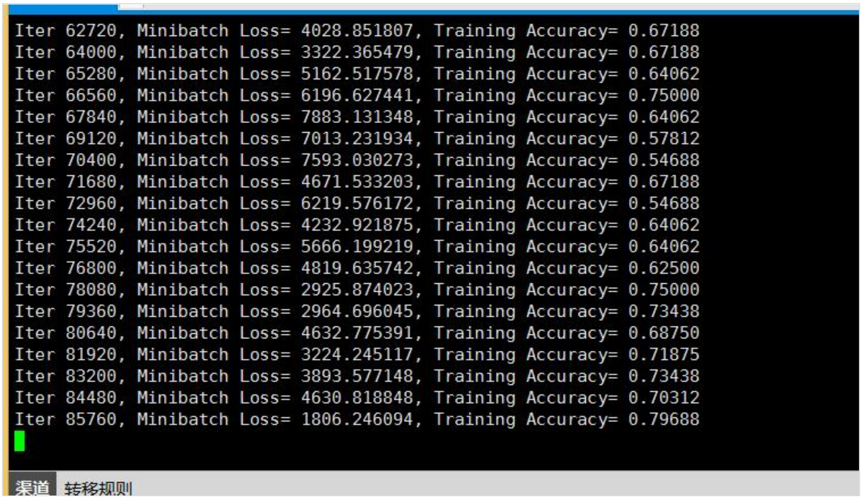
下面是运行的截图



```
root@iZu1cdurunpZ:~/tensorflowtest# python customnet.py
('Extracting', '/tmp/data/train-images-idx3-ubyte.gz')
('Extracting', '/tmp/data/train-labels-idx1-ubyte.gz')
('Extracting', '/tmp/data/t10k-images-idx3-ubyte.gz')
('Extracting', '/tmp/data/t10k-labels-idx1-ubyte.gz')
I tensorflow/core/common_runtime/local_device.cc:25] Local device intra op parallelism threads: 1
I tensorflow/core/common_runtime/local_session.cc:45] Local session inter op parallelism threads: 1
Iter 1280, Minibatch Loss= 84243.226562, Training Accuracy= 0.18750
```

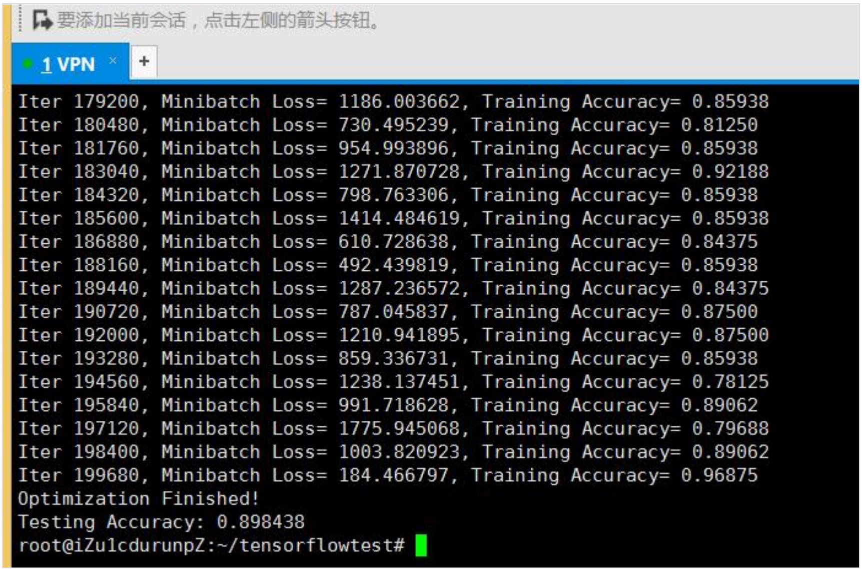


```
root@iZu1cdurunpZ:~/tensorflowtest# vi customnet.py
root@iZu1cdurunpZ:~/tensorflowtest# python customnet.py
('Extracting', '/tmp/data/train-images-idx3-ubyte.gz')
('Extracting', '/tmp/data/train-labels-idx1-ubyte.gz')
('Extracting', '/tmp/data/t10k-images-idx3-ubyte.gz')
('Extracting', '/tmp/data/t10k-labels-idx1-ubyte.gz')
I tensorflow/core/common_runtime/local_device.cc:25] Local device intra op parallelism threads: 1
I tensorflow/core/common_runtime/local_session.cc:45] Local session inter op parallelism threads: 1
Iter 1280, Minibatch Loss= 84243.226562, Training Accuracy= 0.18750
Iter 2560, Minibatch Loss= 50116.703125, Training Accuracy= 0.21875
Iter 3840, Minibatch Loss= 45991.140625, Training Accuracy= 0.39062
Iter 5120, Minibatch Loss= 29725.351562, Training Accuracy= 0.40625
Iter 6400, Minibatch Loss= 28876.570312, Training Accuracy= 0.39062
Iter 7680, Minibatch Loss= 41269.433594, Training Accuracy= 0.31250
Iter 8960, Minibatch Loss= 34481.421875, Training Accuracy= 0.29688
Iter 10240, Minibatch Loss= 26267.462891, Training Accuracy= 0.34375
Iter 11520, Minibatch Loss= 15004.783203, Training Accuracy= 0.51562
Iter 12800, Minibatch Loss= 28135.324219, Training Accuracy= 0.37500
Iter 14080, Minibatch Loss= 28389.318359, Training Accuracy= 0.31250
```



```
Iter 62720, Minibatch Loss= 4028.851807, Training Accuracy= 0.67188
Iter 64000, Minibatch Loss= 3322.365479, Training Accuracy= 0.67188
Iter 65280, Minibatch Loss= 5162.517578, Training Accuracy= 0.64062
Iter 66560, Minibatch Loss= 6196.627441, Training Accuracy= 0.75000
Iter 67840, Minibatch Loss= 7883.131348, Training Accuracy= 0.64062
Iter 69120, Minibatch Loss= 7013.231934, Training Accuracy= 0.57812
Iter 70400, Minibatch Loss= 7593.030273, Training Accuracy= 0.54688
Iter 71680, Minibatch Loss= 4671.533203, Training Accuracy= 0.67188
Iter 72960, Minibatch Loss= 6219.576172, Training Accuracy= 0.54688
Iter 74240, Minibatch Loss= 4232.921875, Training Accuracy= 0.64062
Iter 75520, Minibatch Loss= 5666.199219, Training Accuracy= 0.64062
Iter 76800, Minibatch Loss= 4819.635742, Training Accuracy= 0.62500
Iter 78080, Minibatch Loss= 2925.874023, Training Accuracy= 0.75000
Iter 79360, Minibatch Loss= 2964.696045, Training Accuracy= 0.73438
Iter 80640, Minibatch Loss= 4632.775391, Training Accuracy= 0.68750
Iter 81920, Minibatch Loss= 3224.245117, Training Accuracy= 0.71875
Iter 83200, Minibatch Loss= 3893.577148, Training Accuracy= 0.73438
Iter 84480, Minibatch Loss= 4630.818848, Training Accuracy= 0.70312
Iter 85760, Minibatch Loss= 1806.246094, Training Accuracy= 0.79688
```


最后 精度为89 所以网络设计 是有很多值得考虑的事情 这个后面可能会讲到



```
要添加当前会话，点击左侧的箭头按钮。
1 VPN
Iter 179200, Minibatch Loss= 1186.003662, Training Accuracy= 0.85938
Iter 180480, Minibatch Loss= 730.495239, Training Accuracy= 0.81250
Iter 181760, Minibatch Loss= 954.993896, Training Accuracy= 0.85938
Iter 183040, Minibatch Loss= 1271.870728, Training Accuracy= 0.92188
Iter 184320, Minibatch Loss= 798.763306, Training Accuracy= 0.85938
Iter 185600, Minibatch Loss= 1414.484619, Training Accuracy= 0.85938
Iter 186880, Minibatch Loss= 610.728638, Training Accuracy= 0.84375
Iter 188160, Minibatch Loss= 492.439819, Training Accuracy= 0.85938
Iter 189440, Minibatch Loss= 1287.236572, Training Accuracy= 0.84375
Iter 190720, Minibatch Loss= 787.045837, Training Accuracy= 0.87500
Iter 192000, Minibatch Loss= 1210.941895, Training Accuracy= 0.87500
Iter 193280, Minibatch Loss= 859.336731, Training Accuracy= 0.85938
Iter 194560, Minibatch Loss= 1238.137451, Training Accuracy= 0.78125
Iter 195840, Minibatch Loss= 991.718628, Training Accuracy= 0.89062
Iter 197120, Minibatch Loss= 1775.945068, Training Accuracy= 0.79688
Iter 198400, Minibatch Loss= 1003.820923, Training Accuracy= 0.89062
Iter 199680, Minibatch Loss= 184.466797, Training Accuracy= 0.96875
Optimization Finished!
Testing Accuracy: 0.898438
root@iZu1cdurunpZ:~/tensorflowtest#
```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