Loading the Weights and Biases into a New Model

Sometimes you might want to adjust, or "finetune" a model that you have already trained and saved.

However, loading saved Variables directly into a modified model can generate errors. Let's go over how to avoid these problems.

Naming Error

TensorFlow uses a string identifier for Tensors and Operations called `name`. If a name is not given, TensorFlow will create one automatically. TensorFlow will give the first node the name `<Type>`, and then give the name `<Type>_<number>` for the subsequent nodes. Let's see how this can affect loading a model with a different order of `weights` and `bias`:

```
import tensorflow as tf

# Remove the previous weights and bias
tf.reset_default_graph()

save_file = 'model.ckpt'

# Two Tensor Variables: weights and bias
weights = tf.Variable(tf.truncated_normal([2, 3]))
bias = tf.Variable(tf.truncated_normal([3]))

saver = tf.train.Saver()

# Print the name of Weights and Bias
print('Save Weights: {}'.format(weights.name))
print('Save Bias: {}'.format(bias.name))

with tf.Session() as sess:
    sess.run(tf.global_variables_initializer())
    saver.save(sess, save_file)

# Remove the previous weights and bias
tf.reset_default_graph()

# Two Variables: weights and bias
bias = tf.Variable(tf.truncated_normal([3]))
weights = tf.Variable(tf.truncated_normal([2, 3]))

saver = tf.train.Saver()

# Print the name of Weights and Bias
print('Load Weights: {}'.format(weights.name))
print('Load Bias: {}'.format(bias.name))

with tf.Session() as sess:
    # Load the weights and bias - ERROR
    saver.restore(sess, save_file)
```

The code above prints out the following:

> Save Weights: Variable:0

> Save Bias: Variable_1:0

> Load Weights: Variable_1:0

> Load Bias: Variable:0

> ...

> InvalidArgumentError (see above for traceback): Assign requires shapes of both tensors to match.

> ...

You'll notice that the `name` properties for `weights` and `bias` are different than when you saved the model. This is why the code produces the "Assign requires shapes of both tensors to match" error. The code `saver.restore(sess, save_file)` is trying to load weight data into `bias` and bias data into `weights`.

Instead of letting TensorFlow set the `name` property, let's set it manually:

```
import tensorflow as tf

tf.reset_default_graph()

save_file = 'model.ckpt'

# Two Tensor Variables: weights and bias
weights = tf.Variable(tf.truncated_normal([2, 3]), name='weights_0')
bias = tf.Variable(tf.truncated_normal([3]), name='bias_0')

saver = tf.train.Saver()

# Print the name of Weights and Bias
print('Save Weights: {}'.format(weights.name))
print('Save Bias: {}'.format(bias.name))

with tf.Session() as sess:
    sess.run(tf.global_variables_initializer())
    saver.save(sess, save_file)

# Remove the previous weights and bias
tf.reset_default_graph()

# Two Variables: weights and bias
bias = tf.Variable(tf.truncated_normal([3]), name='bias_0')
weights = tf.Variable(tf.truncated_normal([2, 3]) ,name='weights_0')

saver = tf.train.Saver()

# Print the name of Weights and Bias
print('Load Weights: {}'.format(weights.name))
print('Load Bias: {}'.format(bias.name))

with tf.Session() as sess:
    # Load the weights and bias - No Error
    saver.restore(sess, save_file)

print('Loaded Weights and Bias successfully.')
```

> Save Weights: weights_0:0

> Save Bias: bias_0:0

> Load Weights: weights_0:0

> Load Bias: bias_0:0

> Loaded Weights and Bias successfully.

That worked! The Tensor names match and the data loaded correctly.