Exercise 3

In the videos you looked at how you would improve Fashion MNIST using Convolutions. For your exercise see if you can improve MNIST to 99.8% accuracy or more using only a single convolutional layer and a single MaxPooling 2D. You should stop training once the accuracy goes above this amount. It should happen in less than 20 epochs, so it's ok to hard code the number of epochs for training, but your training must end once it hits the above metric. If it doesn't, then you'll need to redesign your layers.

I've started the code for you -- you need to finish it!

When 99.8% accuracy has been hit, you should print out the string "Reached 99.8% accuracy so cancelling training!"

In [1]:

```python
import tensorflow as tf
from os import path, getcwd, chdir

# DO NOT CHANGE THE LINE BELOW. If you are developing in a local
# environment, then grab mnist.npz from the Coursera Jupyter Notebook
# and place it inside a local folder and edit the path to that location
path = f"{getcwd()}/../tmp2/mnist.npz"
```

In [2]:

```python
config = tf.ConfigProto()
config.gpu_options.allow_growth = True
sess = tf.Session(config=config)
```

```python
# GRADED FUNCTION: train_mnist_conv
def train_mnist_conv():
    # Please write your code only where you are indicated.
    # please do not remove model fitting inline comments.

    # YOUR CODE STARTS HERE
    class myCallback(tf.keras.callbacks.Callback):
        def on_epoch_end(self, epoch, logs={}):
            if(logs.get('acc')>0.998):
                print("Reached 99.8% accuracy so cancelling training!")
                self.model.stop_training = True
    # YOUR CODE ENDS HERE
    callbacks = myCallback()
    mnist = tf.keras.datasets.mnist
    (training_images, training_labels), (test_images, test_labels) = mnist.load_data(path=path)
    # YOUR CODE STARTS HERE
    training_images=training_images.reshape(60000, 28, 28, 1)
    training_images=training_images / 255.0
    test_images = test_images.reshape(10000, 28, 28, 1)
    test_images=test_images/255.0
    # YOUR CODE ENDS HERE

    model = tf.keras.models.Sequential([
            # YOUR CODE STARTS HERE
            tf.keras.layers.Conv2D(32, (3,3), activation='relu', input_shape=(28, 28, 1)),
            tf.keras.layers.MaxPooling2D(2, 2),
            tf.keras.layers.Flatten(),
            tf.keras.layers.Dense(128, activation='relu'),
            tf.keras.layers.Dense(10, activation='softmax')
            # YOUR CODE ENDS HERE
    ])

    model.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
    # model fitting
    history = model.fit(
        # YOUR CODE STARTS HERE
        training_images, training_labels, epochs=10, callbacks=[callbacks]
        # YOUR CODE ENDS HERE
    )
    # model fitting
    return history.epoch, history.history['acc'][-1]
```

```
training_images, training_labels = train_mnist_conv()
```

```
WARNING: Logging before flag parsing goes to stderr.
W0421 16:24:52.617365 140058790385472 deprecation.py:506] From /usr/
local/lib/python3.6/dist-packages/tensorflow/python/ops/init_ops.py:
1251: calling VarianceScaling.__init__ (from tensorflow.python.ops.i
nit_ops) with dtype is deprecated and will be removed in a future ve
rsion.
Instructions for updating:
Call initializer instance with the dtype argument instead of passing
it to the constructor

Epoch 1/10
60000/60000 [==============================] - 20s 328us/sample - lo
ss: 0.1532 - acc: 0.9544
Epoch 2/10
60000/60000 [==============================] - 16s 268us/sample - lo
ss: 0.0507 - acc: 0.9847
Epoch 3/10
60000/60000 [==============================] - 16s 270us/sample - lo
ss: 0.0323 - acc: 0.9900
Epoch 4/10
60000/60000 [==============================] - 16s 273us/sample - lo
ss: 0.0221 - acc: 0.9929
Epoch 5/10
60000/60000 [==============================] - 16s 267us/sample - lo
ss: 0.0142 - acc: 0.9953
Epoch 6/10
60000/60000 [==============================] - 16s 270us/sample - lo
ss: 0.0102 - acc: 0.9967
Epoch 7/10
60000/60000 [==============================] - 16s 270us/sample - lo
ss: 0.0081 - acc: 0.9972
Epoch 8/10
60000/60000 [==============================] - 16s 273us/sample - lo
ss: 0.0068 - acc: 0.9979
Epoch 9/10
60000/60000 [==============================] - 17s 283us/sample - lo
ss: 0.0064 - acc: 0.9978
Epoch 10/10
59936/60000 [=============================>.] - ETA: 0s - loss: 0.003
1 - acc: 0.9991Reached 99.8% accuracy so cancelling training!
60000/60000 [==============================] - 19s 320us/sample - lo
ss: 0.0031 - acc: 0.9991
```

```
# Now click the 'Submit Assignment' button above.
# Once that is complete, please run the following two cells to save your work an
d close the notebook
```