Observations Lab 4_1

Using the model and hyper parameters provided

***Given that the data has been shuffled to split into train and test assume there is no need to shuffle the test set further before splitting into validation and test set.*

```
Training 60,000 samples
Valiation 5000 samples
Test 5000 samples
Epochs = 10
Dropout Rate = 0.2
optimizer='adam',
loss='sparse_categorical_crossentropy',
metrics=['accuracy'])
```

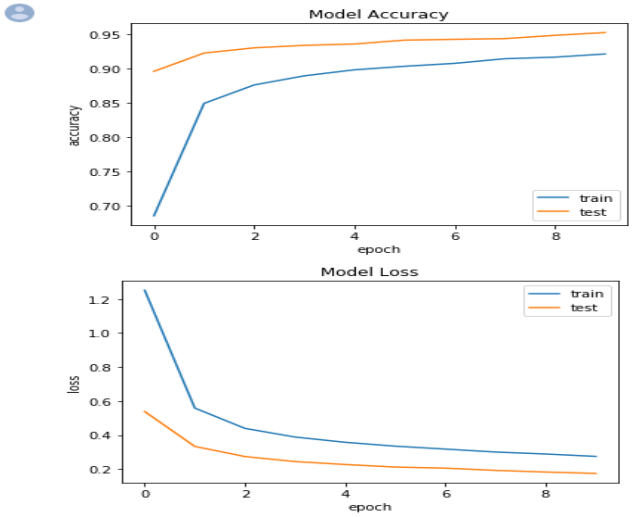
```
Model: "sequential_3"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
flatten (Flatten)            (None, 784)               0
_________________________________________________________________
fc_with_ReLU (Dense)         (None, 128)               100480
_________________________________________________________________
dropout (Dropout)            (None, 128)               0
_________________________________________________________________
fc_softmax_classifier (Dense (None, 10)                1290
=================================================================
Total params: 101,770
Trainable params: 101,770
Non-trainable params: 0
_________________________________________________________________
None
```

Training and Validation Set Evaluation

```
Epoch 10/10
60000/60000 [==============================] - 4s 71us/sample - loss: 0.2743 -
accuracy: 0.9209 - val_loss: 0.1743 - val_accuracy: 0.9520
```

Test Set Evaluation

```
5000/1 - 0s - loss: 0.2439 - accuracy: 0.9102
[0.2989403800010681, 0.9102]
```



Varied Parameters1 - increase the epochs and remove dropout

```
Training 60,000 samples
Valiation 5000 samples
Test 5000 samples
Epochs = 15
Dropout Rate = 0
optimizer='adam',
loss='sparse_categorical_crossentropy',
metrics=['accuracy'])
```

No change to the model therefore the model summary and parameters are unchanged.

No change to the loss and optimiser functions

The number of Epochs increased from 10 to 15 which means the number of times the model runs through the training data with the objective of minimising the loss function increases from 10 to 15

Training and Validation Set Evaluation

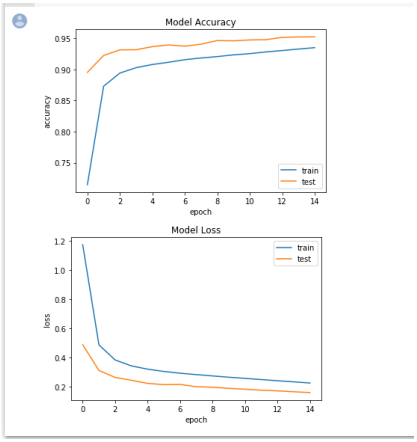
```
Epoch 10/15
60000/60000 [==============================] - 4s 67us/sample - loss:
0.2664 - accuracy: 0.9236 - val_loss: 0.1899 - val_accuracy: 0.9462

Epoch 15/15
60000/60000 [==============================] - 4s 67us/sample - loss: 0.2266 -
accuracy: 0.9352 - val_loss: 0.1610 - val_accuracy: 0.9526
```

We can see that the accuracy of the model has improved though not greatly and the loss function has reduced slightly by increasing the Epochs, until we are able to see what impact the model has had on the test data we will not know if the model has truly become more accurate from increasing the number of ephochs and removing dropout completely from the model or whether the increase in training accuracy is a symptom of over fitting.

Test Set Evaluation - we can see an improvement of 0.5% in the accuracy of the model by increasing the epochs by 5.

```
5000/1 - 0s - loss: 0.2498 - accuracy: 0.9158
[0.2857282984495163, 0.9158]
```



Varied Parameters2 - increase the epochs and reduce dropout

```
Training 60,000 samples
Valiation 5000 samples
Test 5000 samples
Epochs = 15
Dropout Rate = 0.1
optimizer='adam',
loss='sparse_categorical_crossentropy',
metrics=['accuracy'])
```

No change to the model therefore the model summary and parameters are unchanged.

No change to the loss and optimiser functions

The number of Epochs increased from 10 to 15 which means the number of times the model runs through the training data with the objective of minimising the loss function increases from 10 to 15

Dropout reduced to 0.1 - this means that 10% of the time, random parameter s will be dropped from the model during training to reduce complexiety

Training and Validation Set Evaluation

```
Epoch 10/15
60000/60000 [==============================] - 4s 68us/sample - loss: 0.2518 -
accuracy: 0.9262 - val_loss: 0.1705 - val_accuracy: 0.9500

Epoch 15/15
60000/60000 [==============================] - 4s 69us/sample - loss: 0.2038 -
accuracy: 0.9412 - val_loss: 0.1313 - val_accuracy: 0.9634
```

We can see that the accuracy of the model has improved from both the original and the model that excluded dropout

```
5000/1 - 0s - loss: 0.2224 - accuracy: 0.9270
[0.2430098309278488, 0.927]
```

Again the the performance of this model has increased from the original 2 attempts - further tweaking on the number of epochs on the dropout rate could look to improve this model further