

## Homework6 Question1 Sub-Part 2

### Fully-Connected Neural Network Implementation using Tensorflow Keras.

```
Train on 60000 samples
Epoch 1/15
60000/60000 [=====] - 14s 240us/sample - loss: 1.5882 - acc: 0.8727
Epoch 2/15
60000/60000 [=====] - 14s 238us/sample - loss: 1.5881 - acc: 0.8726
Epoch 3/15
60000/60000 [=====] - 14s 237us/sample - loss: 1.5862 - acc: 0.8746
Epoch 4/15
60000/60000 [=====] - 14s 230us/sample - loss: 1.5846 - acc: 0.8760
Epoch 5/15
60000/60000 [=====] - 14s 234us/sample - loss: 1.5821 - acc: 0.8786
Epoch 6/15
60000/60000 [=====] - 14s 232us/sample - loss: 1.5819 - acc: 0.8787
Epoch 7/15
60000/60000 [=====] - 15s 244us/sample - loss: 1.5830 - acc: 0.8777
Epoch 8/15
60000/60000 [=====] - 14s 241us/sample - loss: 1.5833 - acc: 0.8775
Epoch 9/15
60000/60000 [=====] - 15s 244us/sample - loss: 1.5827 - acc: 0.8780
Epoch 10/15
60000/60000 [=====] - 14s 231us/sample - loss: 1.5790 - acc: 0.8817
Epoch 11/15
60000/60000 [=====] - 14s 239us/sample - loss: 1.5773 - acc: 0.8836
Epoch 12/15
60000/60000 [=====] - 14s 236us/sample - loss: 1.5797 - acc: 0.8810
Epoch 13/15
60000/60000 [=====] - 14s 240us/sample - loss: 1.5788 - acc: 0.8823
Epoch 14/15
60000/60000 [=====] - 14s 232us/sample - loss: 1.5800 - acc: 0.8808
Epoch 15/15
60000/60000 [=====] - 15s 243us/sample - loss: 1.5770 - acc: 0.8838
<tensorflow.python.keras.callbacks.History at 0x7f1acaefd2b0>
```

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### Test Accuracy:

```
10000/10000 - 0s - loss: 1.5987 - acc: 0.8627
```

```
Test accuracy: 0.8627
```

## Homework6 Question1 Sub-Part 3

### Convolutional Neural Network Implementation using Tensorflow Keras.

```
Epoch 16/25
48000/48000 [=====] - 100s 2ms/sample - loss: 0.2855 - acc: 0.8953 - val_loss: 0.2517 - val_acc: 0.9106
Epoch 17/25
48000/48000 [=====] - 100s 2ms/sample - loss: 0.2832 - acc: 0.8971 - val_loss: 0.2320 - val_acc: 0.9171
Epoch 18/25
48000/48000 [=====] - 100s 2ms/sample - loss: 0.2848 - acc: 0.8975 - val_loss: 0.2453 - val_acc: 0.9149
Epoch 19/25
48000/48000 [=====] - 96s 2ms/sample - loss: 0.2811 - acc: 0.8980 - val_loss: 0.2452 - val_acc: 0.9143
Epoch 20/25
48000/48000 [=====] - 106s 2ms/sample - loss: 0.2766 - acc: 0.9000 - val_loss: 0.2503 - val_acc: 0.9128
Epoch 21/25
48000/48000 [=====] - 102s 2ms/sample - loss: 0.2770 - acc: 0.9005 - val_loss: 0.2564 - val_acc: 0.9087
Epoch 22/25
48000/48000 [=====] - 104s 2ms/sample - loss: 0.2825 - acc: 0.8975 - val_loss: 0.2448 - val_acc: 0.9101
Epoch 23/25
48000/48000 [=====] - 104s 2ms/sample - loss: 0.2742 - acc: 0.9008 - val_loss: 0.2438 - val_acc: 0.9147
Epoch 24/25
48000/48000 [=====] - 104s 2ms/sample - loss: 0.2783 - acc: 0.8987 - val_loss: 0.2619 - val_acc: 0.9097
Epoch 25/25
48000/48000 [=====] - 104s 2ms/sample - loss: 0.2782 - acc: 0.8990 - val_loss: 0.2578 - val_acc: 0.9062
```

Test Accuracy:

Test accuracy: 0.9056