Implementation

Using a convolutional neural network, we use a dataset based on handwritten digits. I used a training size of 2000 and a test size of 400. I implemented evaluate which performs forward propagation on the neural network. The input is taken as an image while the output is the true label y.

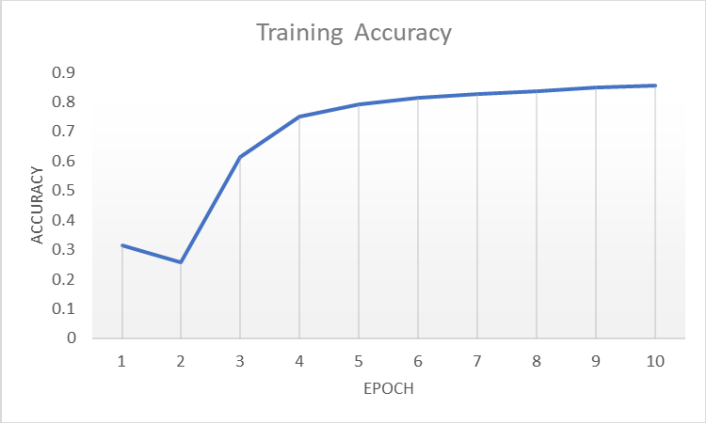
Results

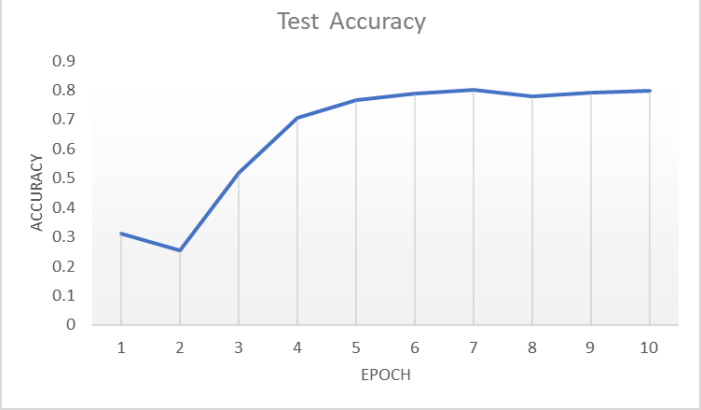
The four values I obtained for training loss/accuracy and test loss/accuracy after implementing the evaluate function are: Train Acc: 0.8545, Train Loss: 0.408013, Test Acc: 0.7945, Test Loss: 0.5234925. The graphs in blue shown below represent these values.

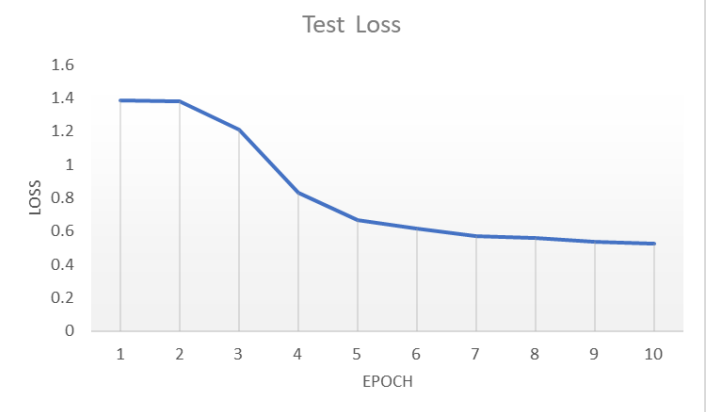
For the baseline code, the values I received for training loss/accuracy and test loss/accuracy are loss: 0.0662 - accuracy: 0.9803 - val_loss: 0.0605 - val_accuracy: 0.9804, where val_loss and val_accuracy are the test loss and accuracy respectively.

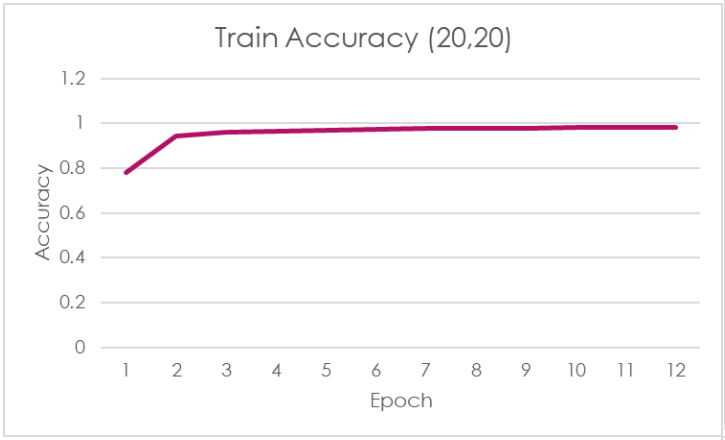
After changing the kernel size to (5,5), the values I obtained are: loss: 0.0688 - accuracy: 0.9796 - val_loss: 0.0614 - val_accuracy: 0.9808.

I redid the experiment with different numbers of feature maps for the first and second layers of the convolution map. After trying 11 different combinations, the optimal combination was (20, 20). The values I obtained are loss: 0.0552 - accuracy: 0.9829 - val_loss: 0.0540 - val_accuracy: 0.9828. The plots in red show the training loss/accuracy and test loss/accuracy for X = 20 and Y = 20.

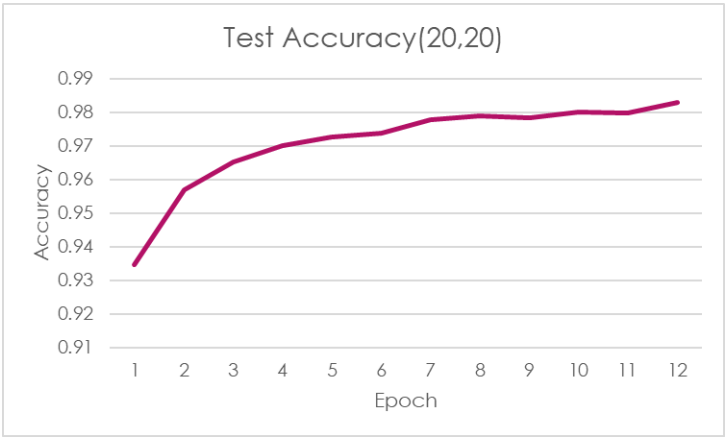


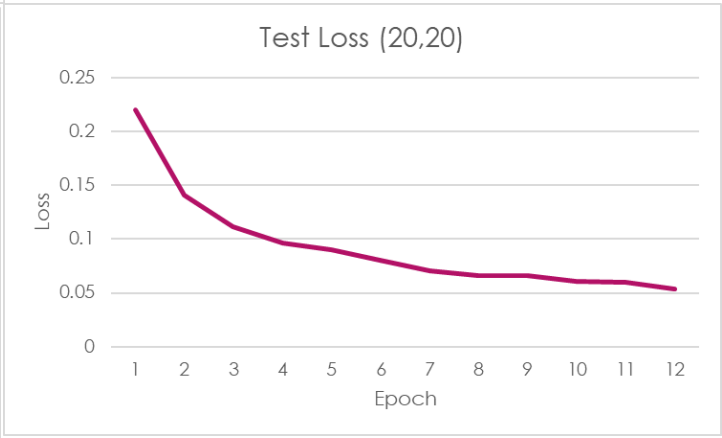





Train Accuracy (20,20)
Accuracy
1.2
1
0.8
0.6
0.4
0.2
0
1 2 3 4 5 6 7 8 9 10 11 12
Epoch


Train Loss (20,20)
Loss
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1 2 3 4 5 6 7 8 9 10 11 12
Epoch


Test Accuracy(20,20)
Accuracy
0.99
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.91
1 2 3 4 5 6 7 8 9 10 11 12
Epoch


Test Loss (20,20)
Loss
0.25
0.2
0.15
0.1
0.05
0
1 2 3 4 5 6 7 8 9 10 11 12
Epoch