Neural Networks Task #3 Report

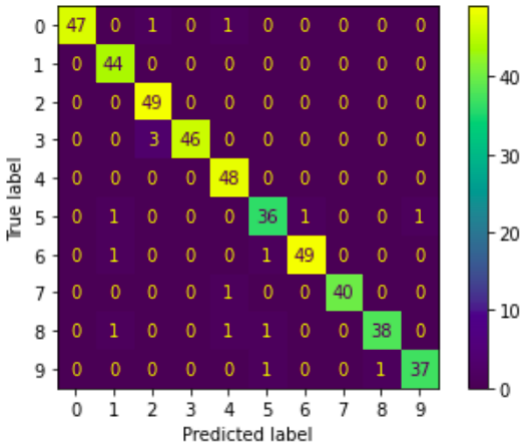
MLP From Scratch on MINST Digits Dataset

Activation	Train Acc	Test Acc	LR	Epochs	#Layers	Nodes
Sigmoid	0.999	0.96444	0.1	1000	2	32, 16
Tanh	0.998	0.96666	0.1	1000	3	64, 32, 16

Sigmoid Screenshots

```
[INFO] loading MNIST (sample) dataset...
[INFO] samples: 1797, dim: 64
[INFO] training network...
[INFO] activation function -sigmoid
[INFO] NeuralNetwork: 64-32-16-10
[INFO] epoch=1, loss=605.7848520
[INFO] epoch=100, loss=7.0319697
[INFO] epoch=200, loss=1.7723014
[INFO] epoch=300, loss=1.1161347
[INFO] epoch=400, loss=0.9032981
[INFO] epoch=500, loss=0.7974797
[INFO] epoch=600, loss=0.7344595
[INFO] epoch=700, loss=0.6927962
[INFO] epoch=800, loss=0.6632907
[INFO] epoch=900, loss=0.6413475
[INFO] epoch=1000, loss=0.6244187
[INFO] evaluating network...

[INFO] Classificaction Report ..
              precision    recall  f1-score   support

           0       1.00      0.96      0.98        49
           1       0.94      1.00      0.97        44
           2       0.92      1.00      0.96        49
           3       1.00      0.94      0.97        49
           4       0.94      1.00      0.97        48
           5       0.92      0.92      0.92        39
           6       0.98      0.96      0.97        51
           7       1.00      0.98      0.99        41
           8       0.97      0.93      0.95        41
           9       0.97      0.95      0.96        39

    accuracy                           0.96       450
   macro avg       0.97      0.96      0.96       450
weighted avg       0.97      0.96      0.96       450


[INFO] Training Accuracy : 0.9992576095025983
[INFO] Testing Accuracy : 0.9644444444444444
```

Sigmoid training & evaluation process

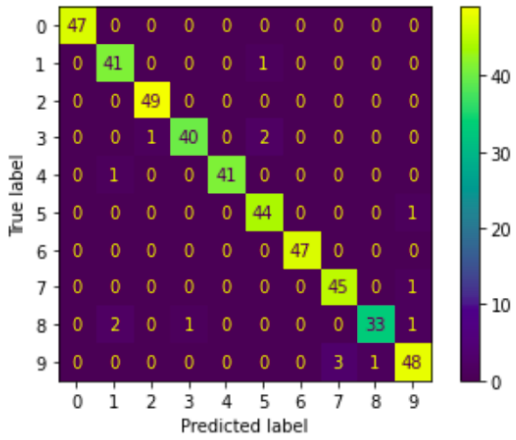


Sigmoid Confusion matrix

Tanh Screenshots

```
[INFO] loading MNIST (sample) dataset...
[INFO] samples: 1797, dim: 64
[INFO] training network...
[INFO] activation function -tanh
[INFO] NeuralNetwork: 64-64-32-16-10
[INFO] epoch=1, loss=317.7998785
[INFO] epoch=100, loss=14.1390496
[INFO] epoch=200, loss=8.1128356
[INFO] epoch=300, loss=6.7936950
[INFO] epoch=400, loss=7.6078156
[INFO] epoch=500, loss=4.1994109
[INFO] epoch=600, loss=4.7607738
[INFO] epoch=700, loss=5.9945509
[INFO] epoch=800, loss=110.8192635
[INFO] epoch=900, loss=5.9138686
[INFO] epoch=1000, loss=26.9647871
[INFO] evaluating network...

[INFO] Classificaction Report ..
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        47
           1       0.93      0.98      0.95        42
           2       0.98      1.00      0.99        49
           3       0.98      0.93      0.95        43
           4       1.00      0.98      0.99        42
           5       0.94      0.98      0.96        45
           6       1.00      1.00      1.00        47
           7       0.94      0.98      0.96        46
           8       0.97      0.89      0.93        37
           9       0.94      0.92      0.93        52

    accuracy                           0.97       450
   macro avg       0.97      0.97      0.97       450
weighted avg       0.97      0.97      0.97       450


[INFO] Training Accuracy : 0.9985152190051967
[INFO] Testing Accuracy : 0.9666666666666667
```

Tanh training & evaluation process



Tanh Confusion matrix