Report

Machine Learning Sessional - Offline 03

Submitted by
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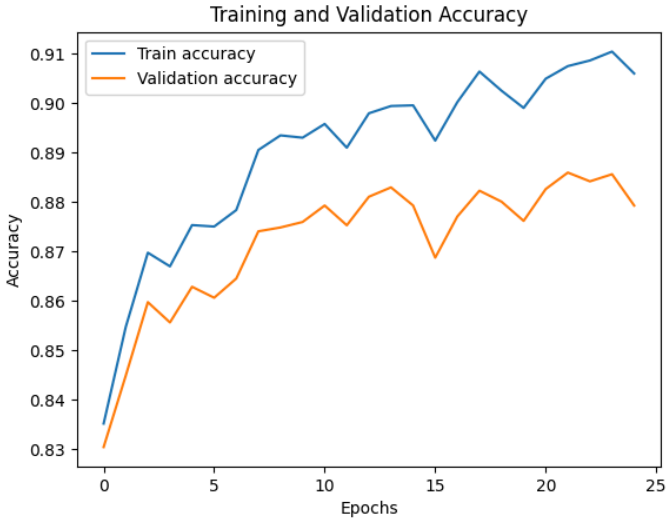
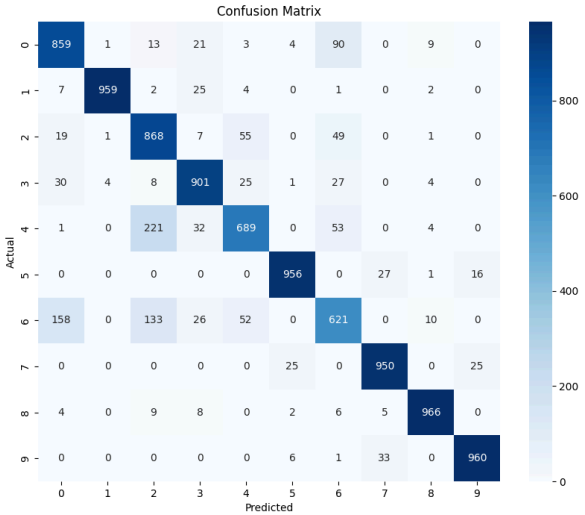
Model 1 :

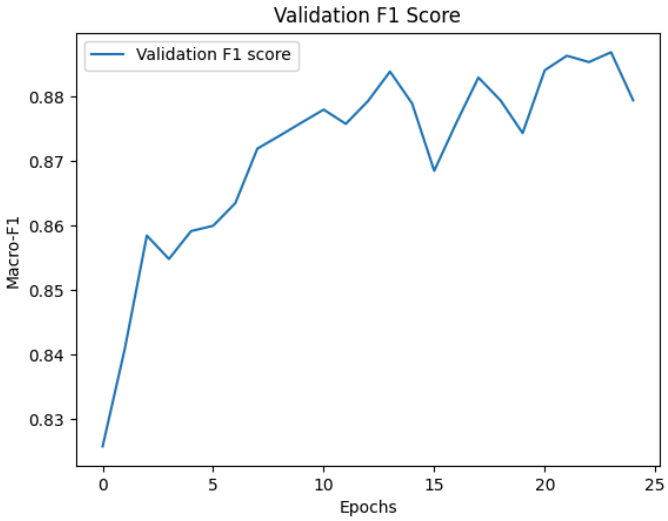
Number of layers = 4
Dropout rate = 0.4
Number of epochs = 25
Neurons in each layer = 128, 64, 32, 16

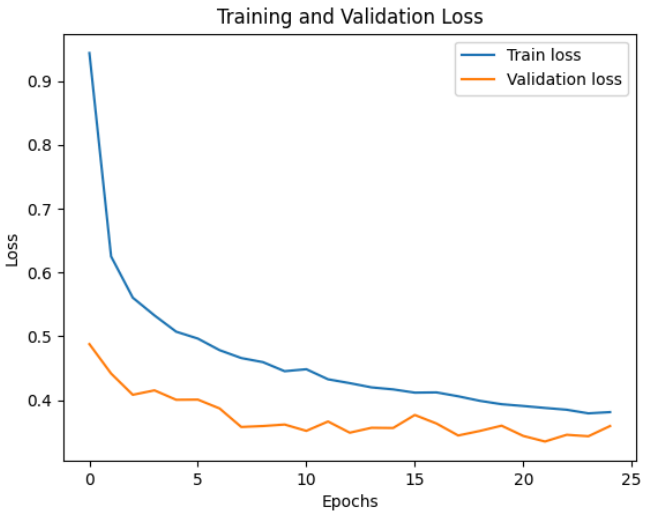
Learning rate = 0.005

```
Loss: 0.3810, Val Loss: 0.3592, Train Acc: 0.9061, Val Acc: 0.8793, Val F1: 0.8794
```



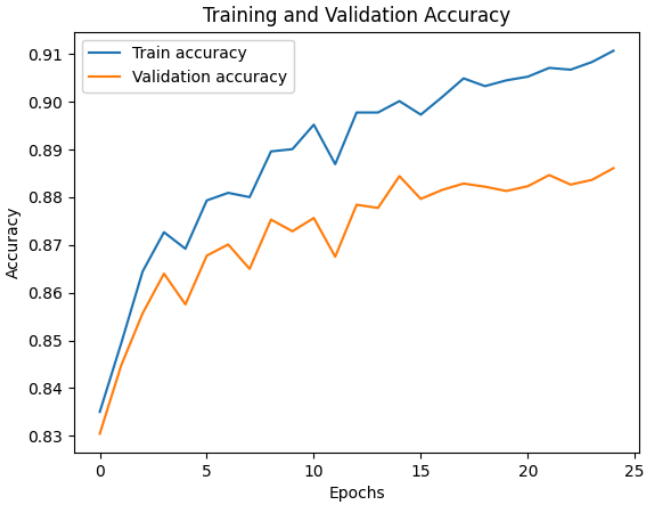


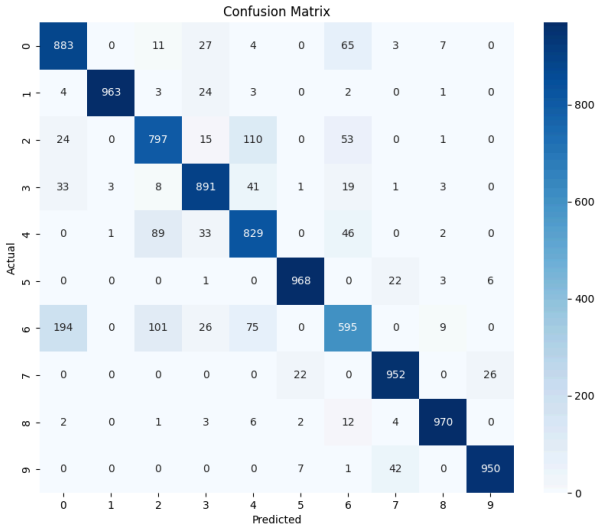


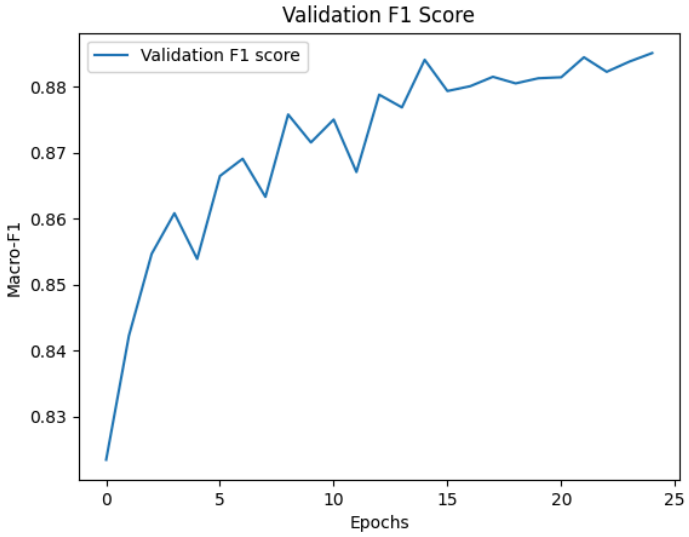


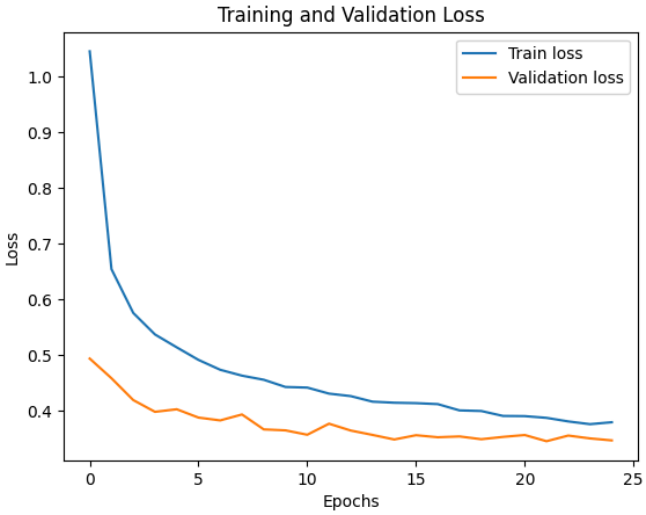
Learning rate = 0.003

```
Loss: 0.3796, Val Loss: 0.3470, Train Acc: 0.9107, Val Acc: 0.8861, Val
F1: 0.8851
```



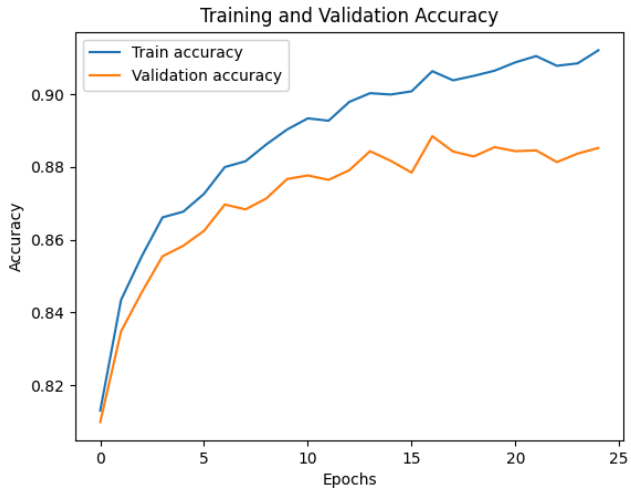

Confusion Matrix
Actual
Predicted
0 1 2 3 4 5 6 7 8 9
883 0 11 27 4 0 65 3 7 0
4 963 3 24 3 0 2 0 1 0
24 0 797 15 110 0 53 0 1 0
33 3 8 891 41 1 19 1 3 0
0 1 89 33 829 0 46 0 2 0
0 0 0 1 0 968 0 22 3 6
194 0 101 26 75 0 595 0 9 0
0 0 0 0 0 22 0 952 0 26
2 0 1 3 6 2 12 4 970 0
0 0 0 0 0 7 1 42 0 950
800
600
400
200
0

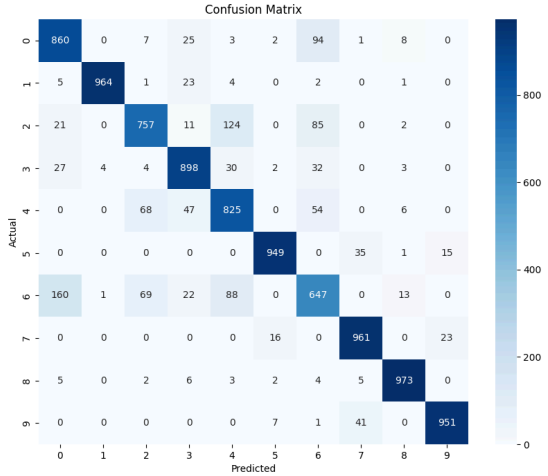

Validation F1 Score
Validation F1 score
Macro-F1
Epochs
0.88
0.87
0.86
0.85
0.84
0.83
0
5
10
15
20
25

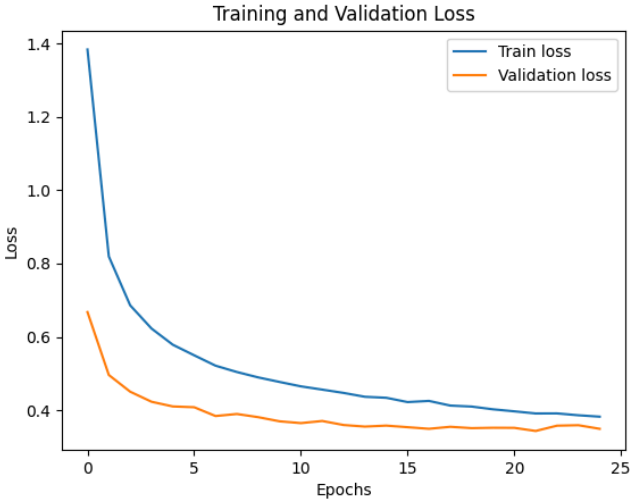

Training and Validation Loss
Train loss
Validation loss
Loss
Epochs
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0
5
10
15
20
25

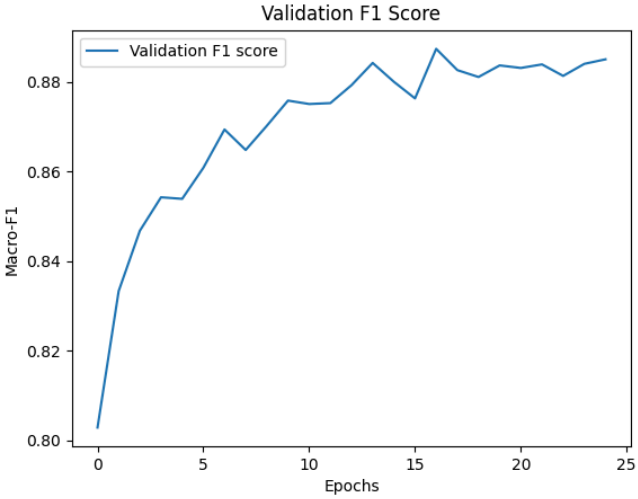
Learning rate = 0.001

```
Loss: 0.3827, Val Loss: 0.3496, Train Acc: 0.9121, Val Acc: 0.8852, Val
F1: 0.8850
```



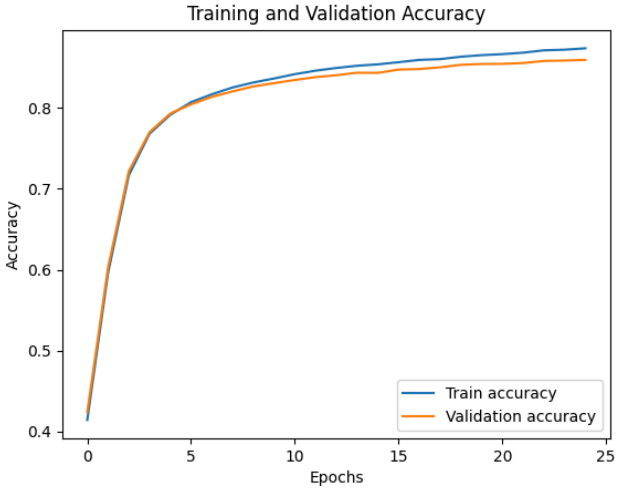


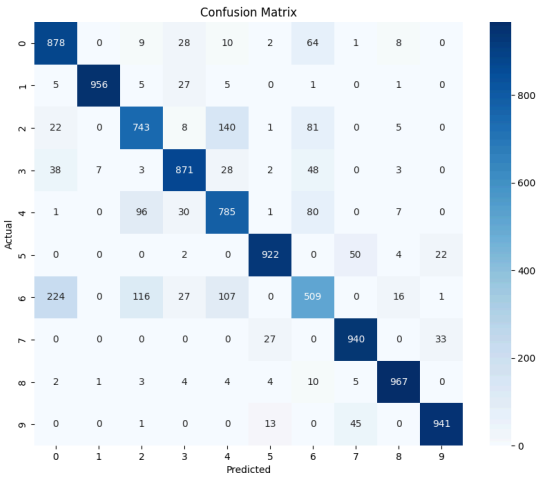


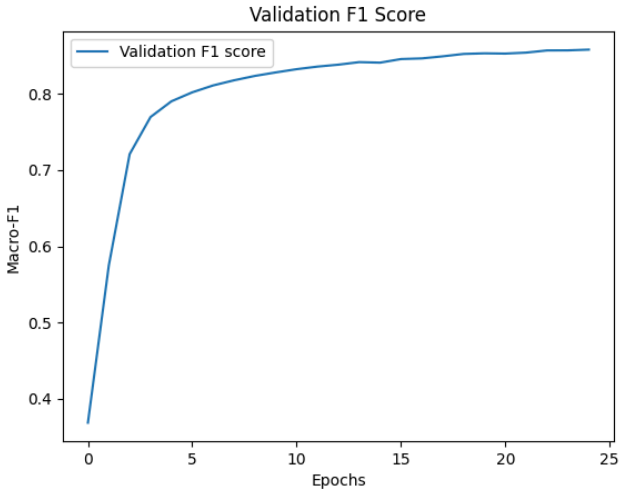


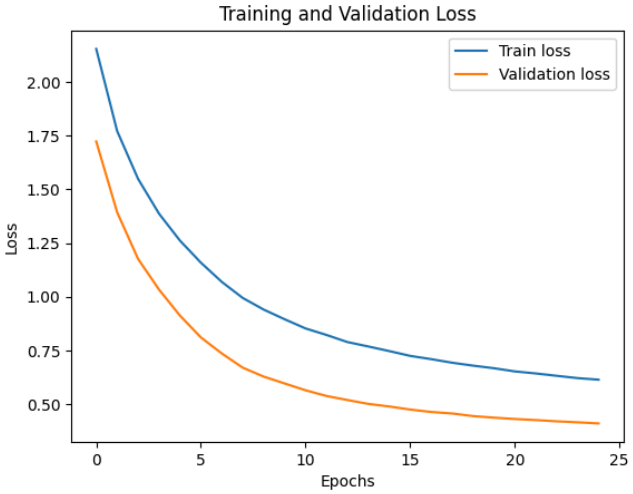
Learning rate = 0.0001

```
Loss: 0.6150, Val Loss: 0.4115, Train Acc: 0.8740, Val Acc: 0.8597, Val F1: 0.8578
```







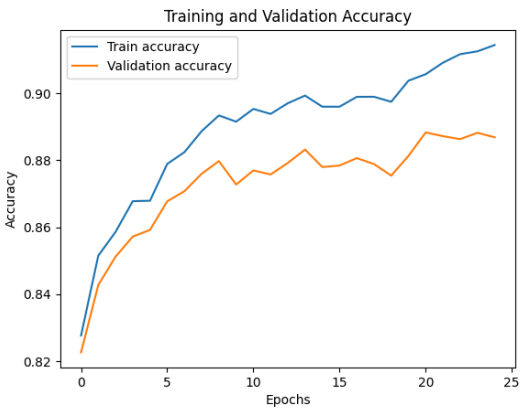


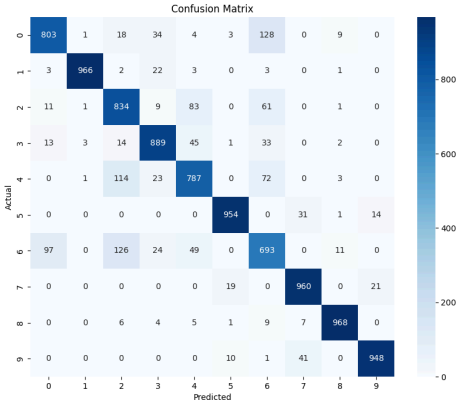
Model 2 :

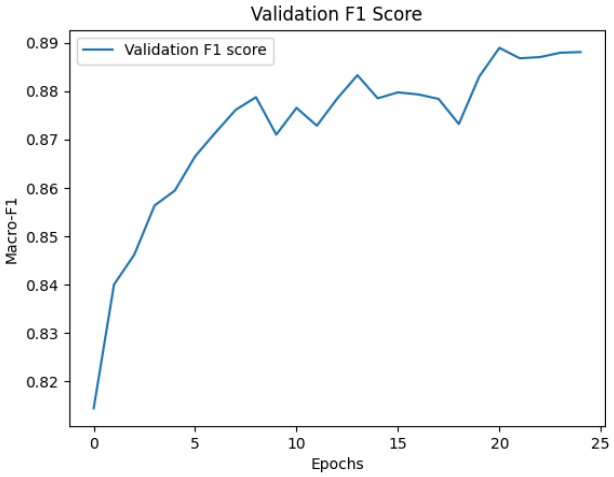
Number of layers = 5
Dropout rate = 0.4
Number of epochs = 25
Neurons in each layer = 256, 128, 64, 32, 16

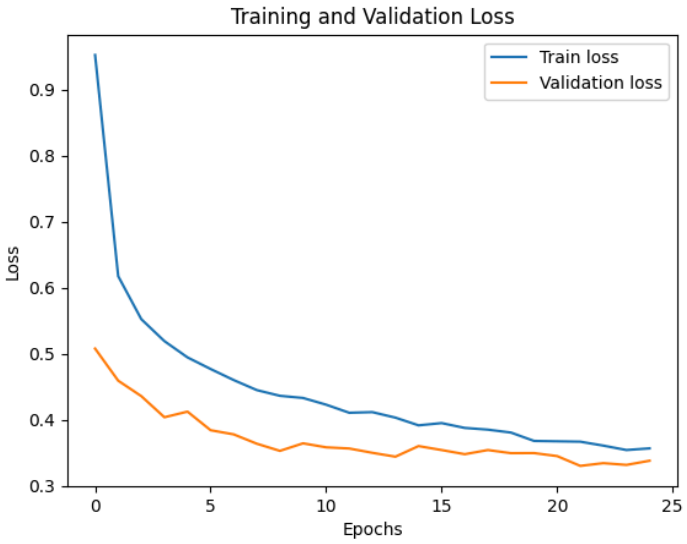
Learning rate = 0.005

```
Loss: 0.3569, Val Loss: 0.3382, Train Acc: 0.9144, Val Acc: 0.8869, Val F1: 0.8881
```


Training and Validation Accuracy
Train accuracy
Validation accuracy
Accuracy
Epochs

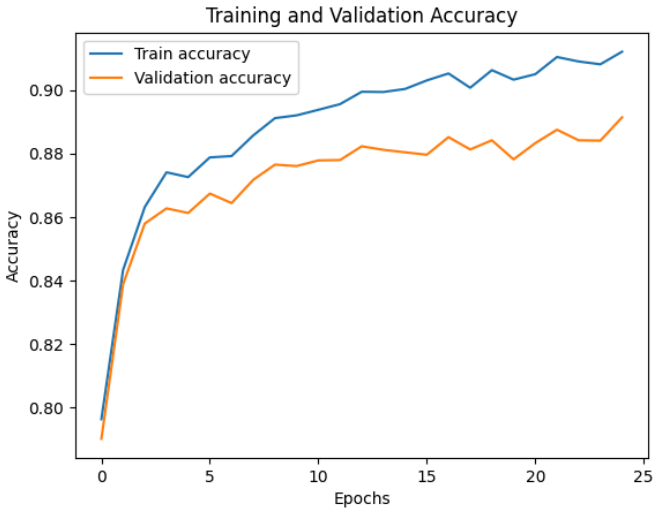

Confusion Matrix
Actual
Predicted

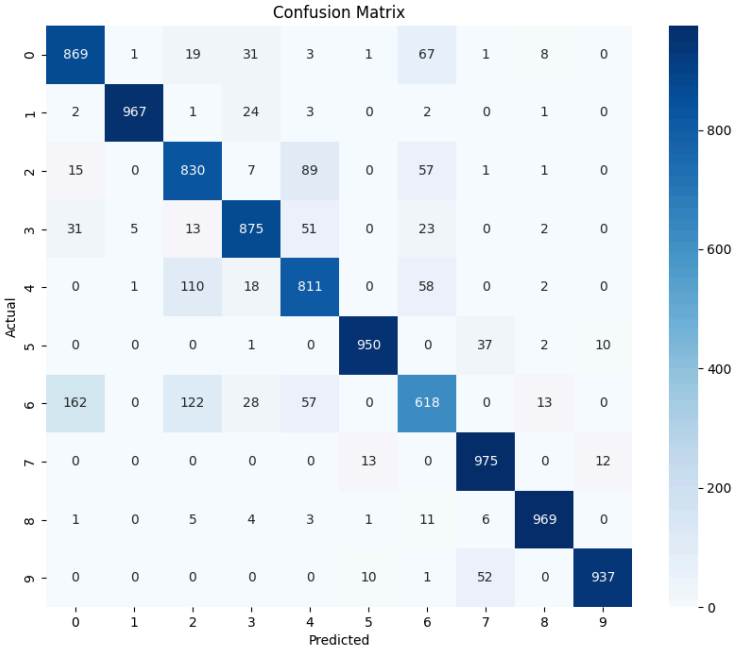

Validation F1 Score
Validation F1 score
Macro-F1
Epochs

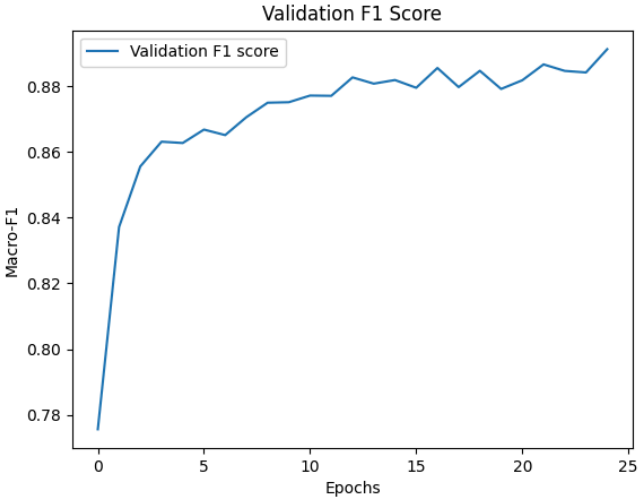

Training and Validation Loss
Train loss
Validation loss
Loss
Epochs

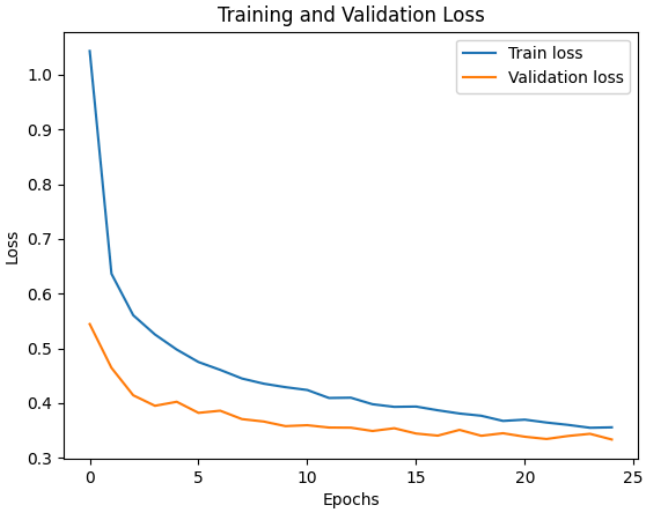
Learning rate = 0.003

```
Loss: 0.3558, Val Loss: 0.3335, Train Acc: 0.9121, Val Acc: 0.8914, Val
F1: 0.8914
```



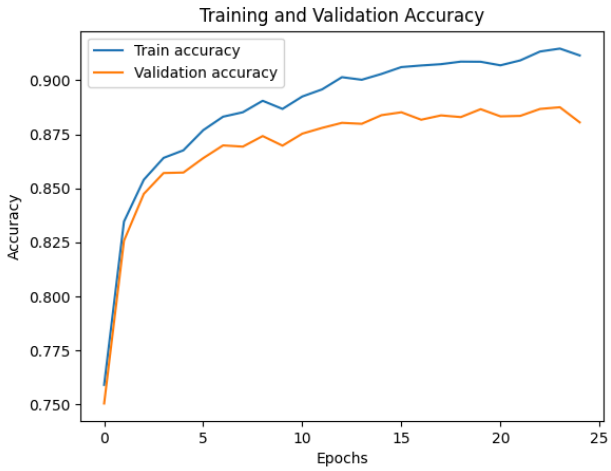


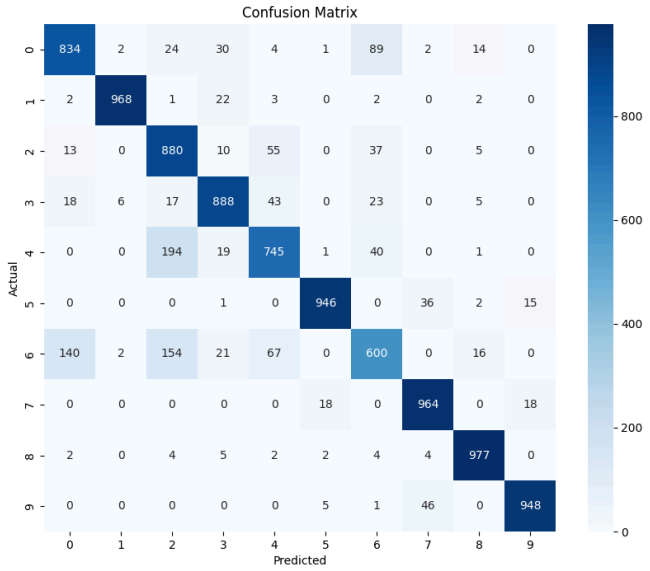


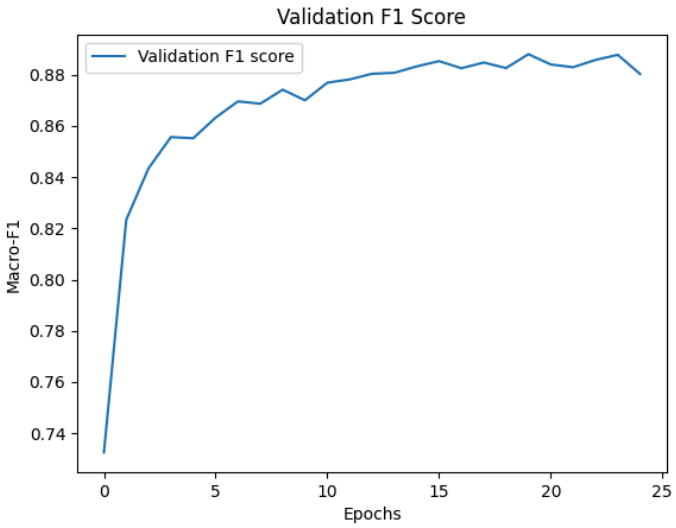


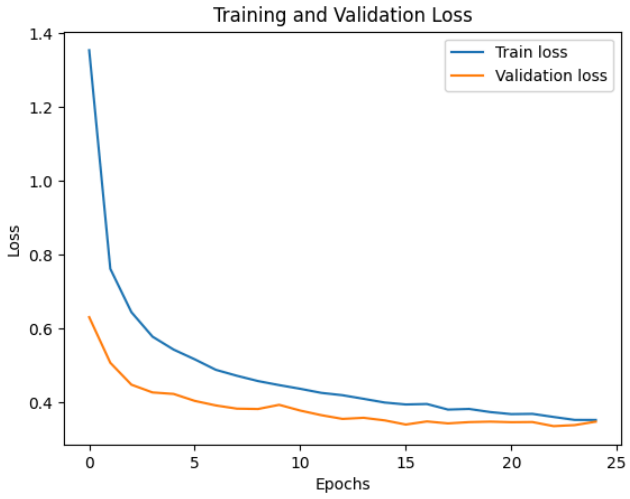
Learning rate = 0.001

```
Loss: 0.3524, Val Loss: 0.3478, Train Acc: 0.9115, Val Acc: 0.8806, Val
F1: 0.8803
```



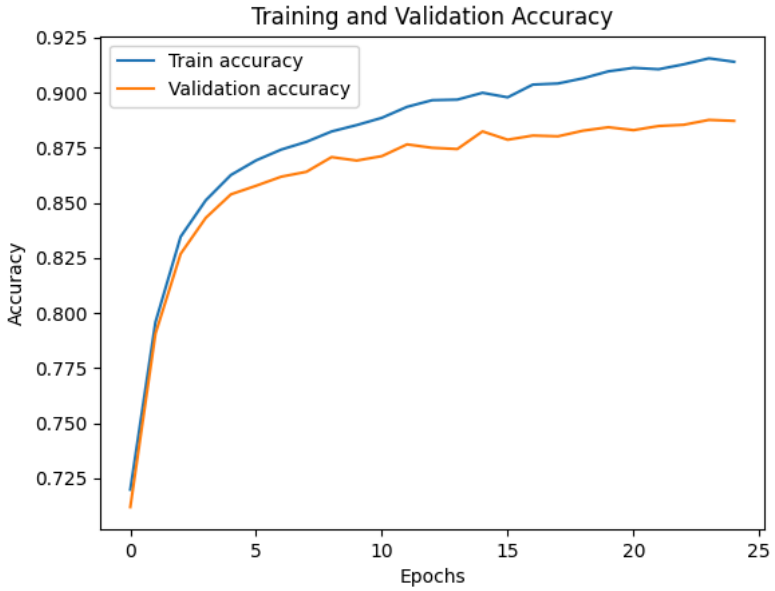

Confusion Matrix
Actual
Predicted
0 834 2 24 30 4 1 89 2 14 0
1 2 968 1 22 3 0 2 0 2 0
2 13 0 880 10 55 0 37 0 5 0
3 18 6 17 888 43 0 23 0 5 0
4 0 0 194 19 745 1 40 0 1 0
5 0 0 0 1 0 946 0 36 2 15
6 140 2 154 21 67 0 600 0 16 0
7 0 0 0 0 0 18 0 964 0 18
8 2 0 4 5 2 2 4 4 977 0
9 0 0 0 0 0 5 1 46 0 948
0 1 2 3 4 5 6 7 8 9
800
600
400
200
0

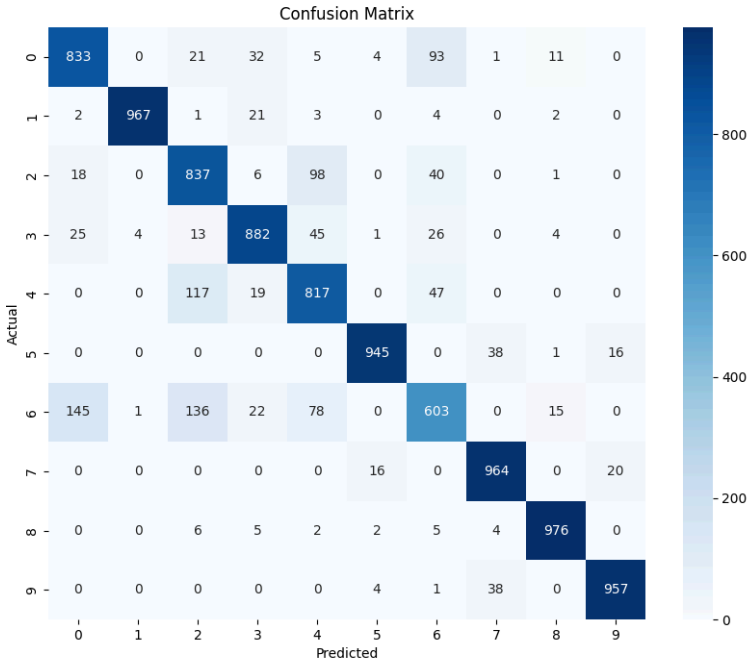

Validation F1 Score
Validation F1 score
Macro-F1
Epochs
0.88
0.86
0.84
0.82
0.80
0.78
0.76
0.74
0
5
10
15
20
25

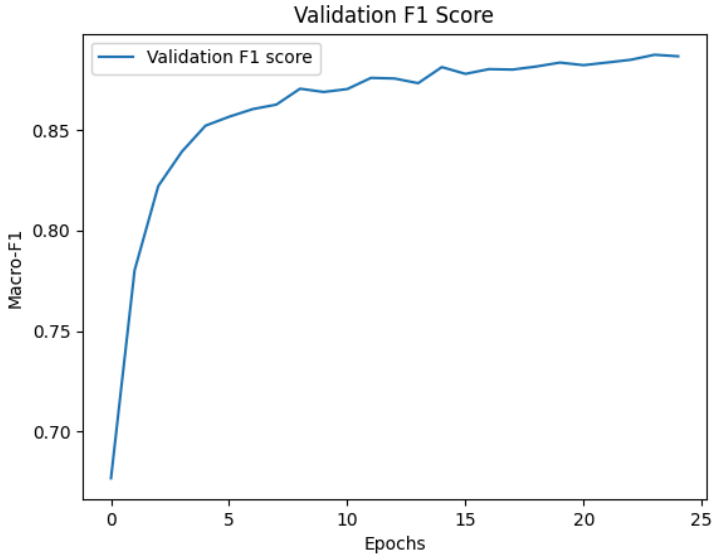

Training and Validation Loss
Train loss
Validation loss
Loss
Epochs
1.4
1.2
1.0
0.8
0.6
0.4
0
5
10
15
20
25

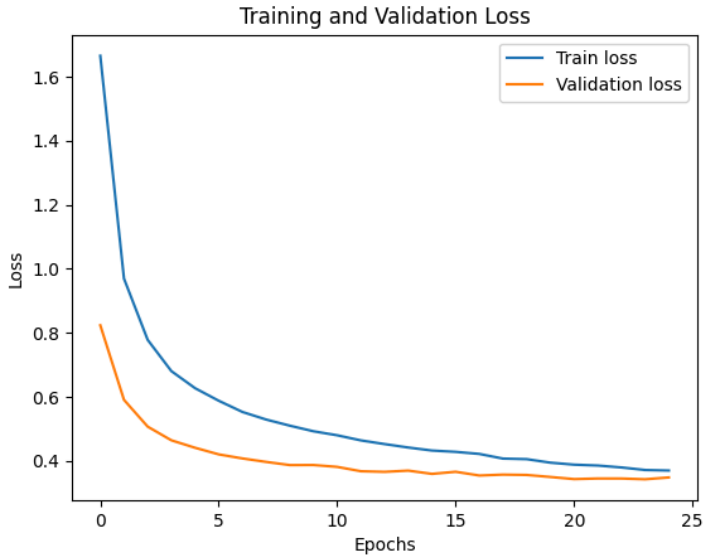
Learning rate = 0.0005

```
Loss: 0.3701, Val Loss: 0.3485, Train Acc: 0.9140, Val Acc: 0.8872, Val
F1: 0.8869
```







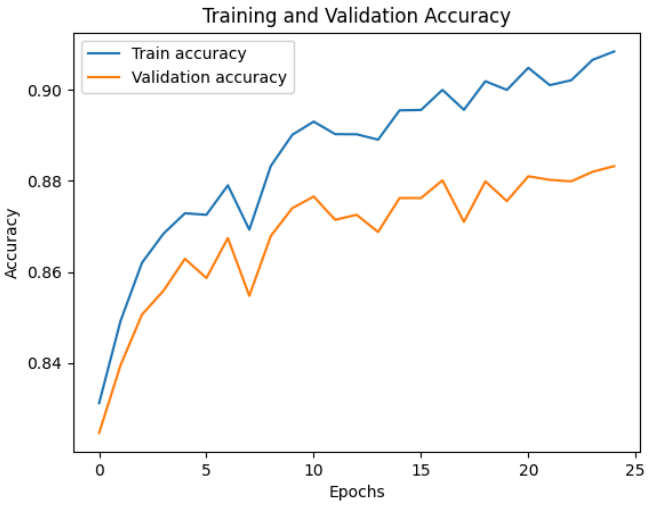


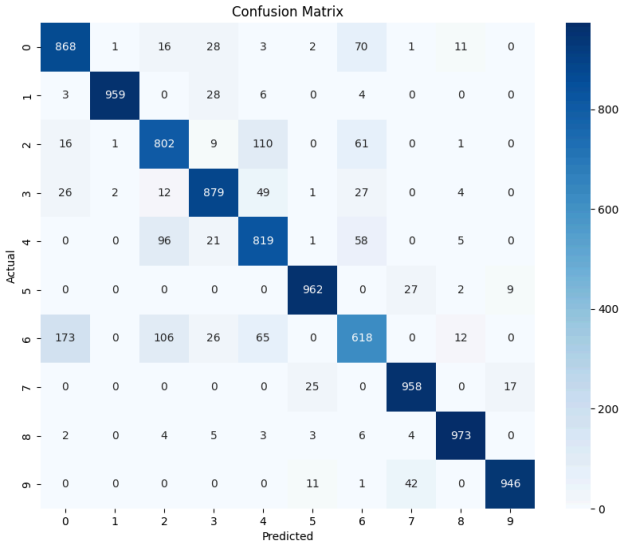
Model 3 :

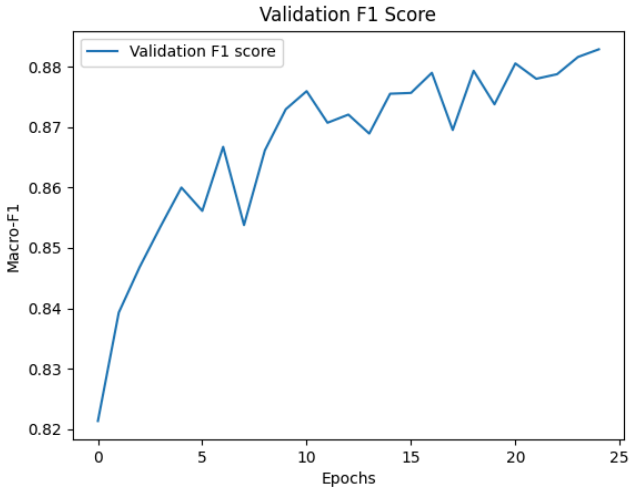
Number of layers = 3
Dropout rate = 0.4
Number of epochs = 25
Neurons in each layer = 128, 64, 32

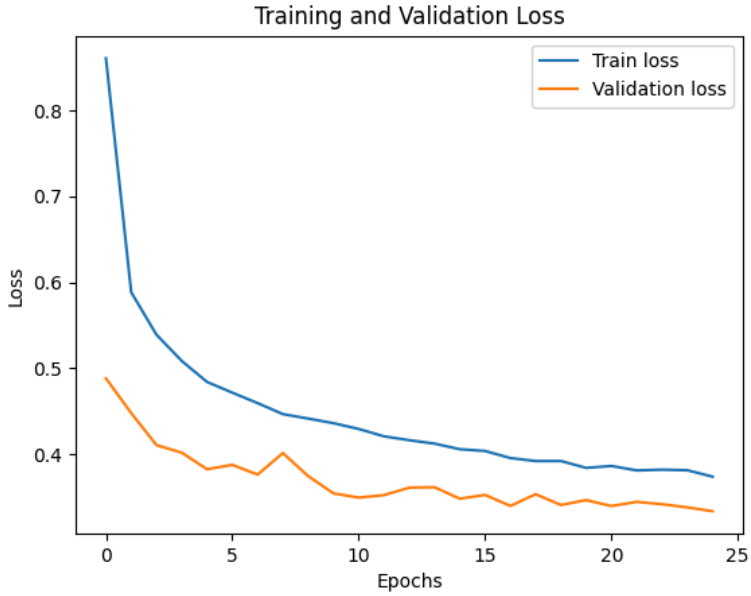
Learning rate = 0.005

```
Loss: 0.3739, Val Loss: 0.3337, Train Acc: 0.9084, Val Acc: 0.8832, Val F1: 0.8829
```


Training and Validation Accuracy
Train accuracy
Validation accuracy
Accuracy
Epochs
0.90
0.88
0.86
0.84
0
5
10
15
20
25

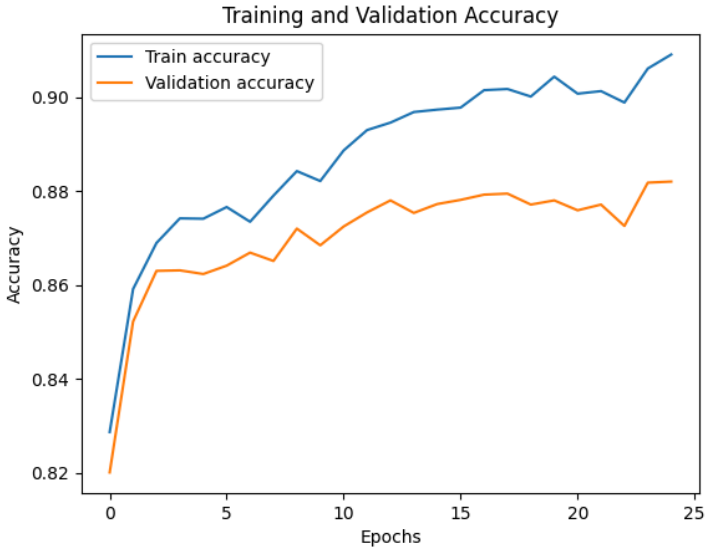

Confusion Matrix
Actual
Predicted
868 1 16 28 3 2 70 1 11 0
3 959 0 28 6 0 4 0 0 0
16 1 802 9 110 0 61 0 1 0
26 2 12 879 49 1 27 0 4 0
0 0 96 21 819 1 58 0 5 0
0 0 0 0 0 962 0 27 2 9
173 0 106 26 65 0 618 0 12 0
0 0 0 0 0 25 0 958 0 17
2 0 4 5 3 3 6 4 973 0
0 0 0 0 0 11 1 42 0 946
0 1 2 3 4 5 6 7 8 9
800
600
400
200
0

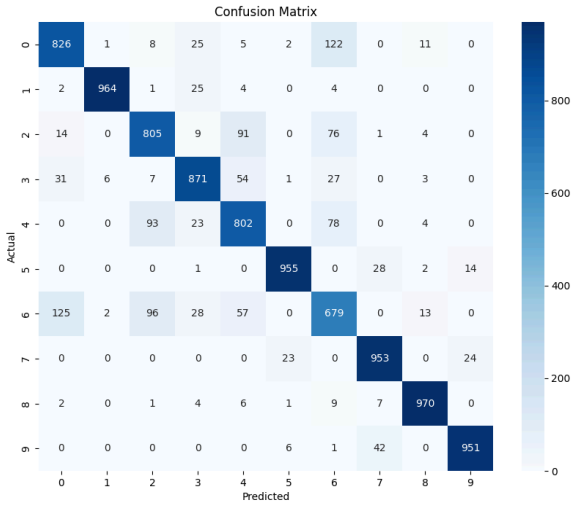

Validation F1 Score
Validation F1 score
Macro-F1
Epochs
0.88
0.87
0.86
0.85
0.84
0.83
0.82
0
5
10
15
20
25

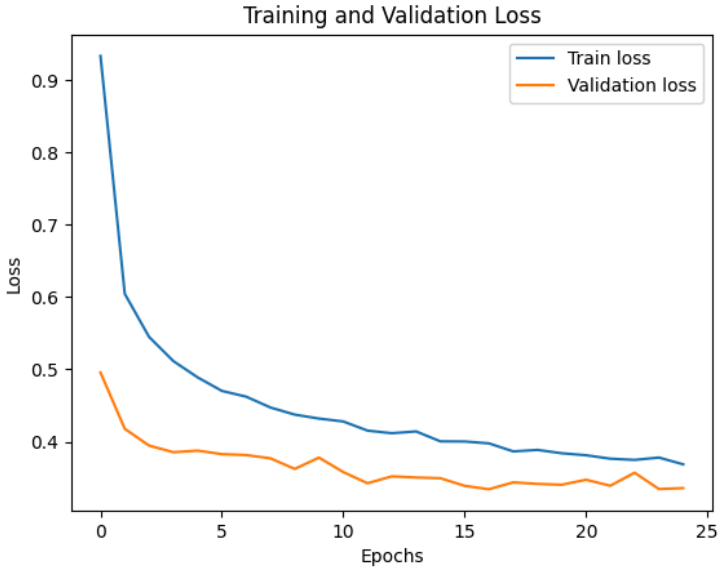


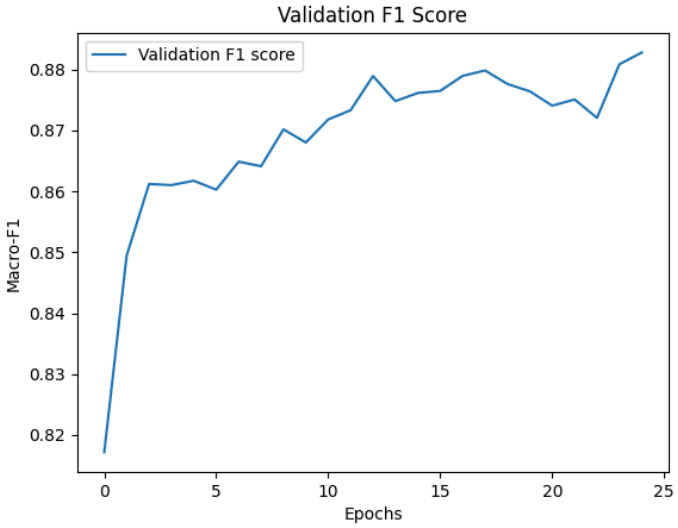
Learning rate = 0.003

```
Loss: 0.3688, Val Loss: 0.3359, Train Acc: 0.9090, Val Acc: 0.8820, Val
F1: 0.8828
```



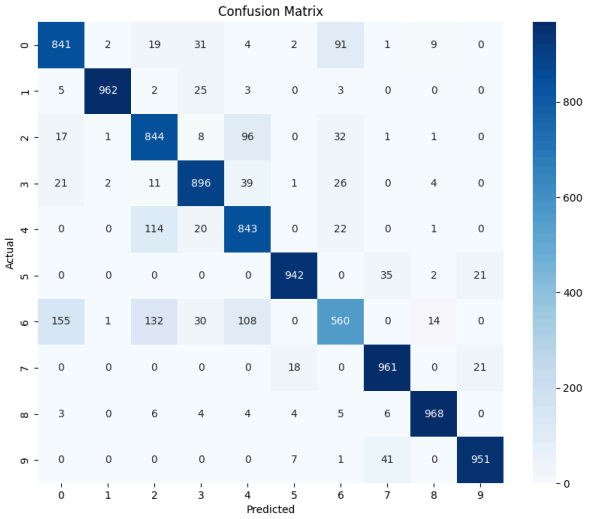

Confusion Matrix
Actual
Predicted
0 826 1 8 25 5 2 122 0 11 0
1 2 964 1 25 4 0 4 0 0 0
2 14 0 805 9 91 0 76 1 4 0
3 31 6 7 871 54 1 27 0 3 0
4 0 0 93 23 802 0 78 0 4 0
5 0 0 0 1 0 955 0 28 2 14
6 125 2 96 28 57 0 679 0 13 0
7 0 0 0 0 0 23 0 953 0 24
8 2 0 1 4 6 1 9 7 970 0
9 0 0 0 0 0 6 1 42 0 951
0 1 2 3 4 5 6 7 8 9
800
600
400
200
0

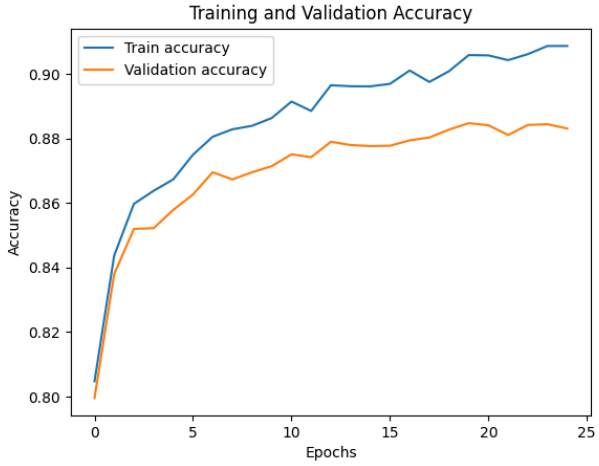

Training and Validation Loss
Train loss
Validation loss
Loss
Epochs
0.9
0.8
0.7
0.6
0.5
0.4
0
5
10
15
20
25

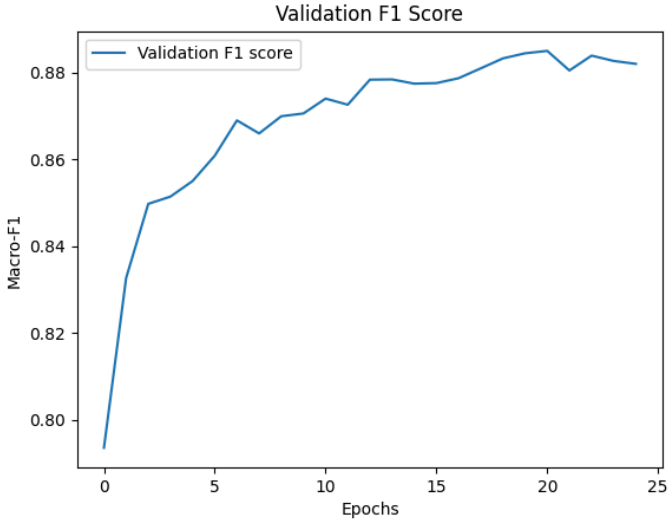

Validation F1 Score
Validation F1 score
Macro-F1
Epochs
0.88
0.87
0.86
0.85
0.84
0.83
0.82
0
5
10
15
20
25

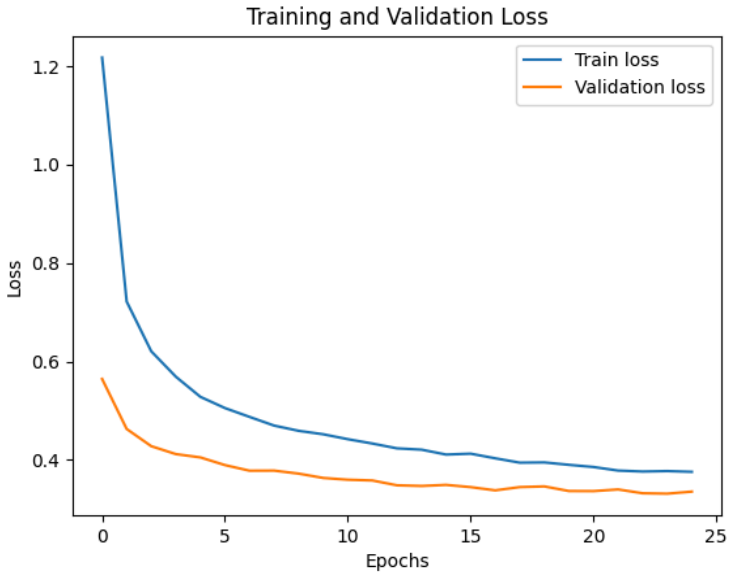
Learning rate = 0.001

```
Loss: 0.3761, Val Loss: 0.3359, Train Acc: 0.9087, Val Acc: 0.8831, Val
F1: 0.8820
```



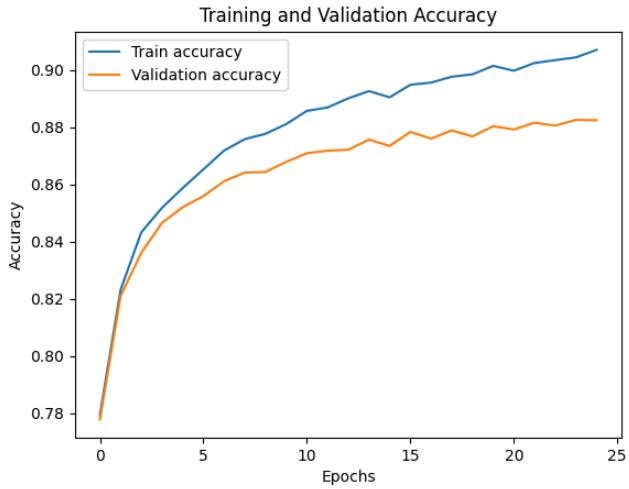


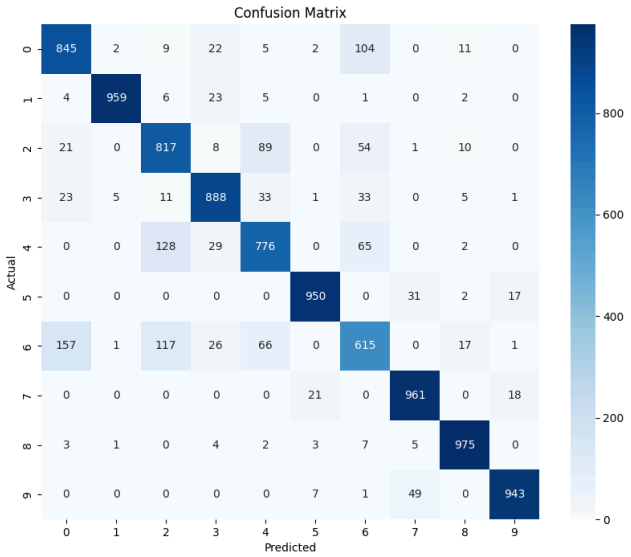


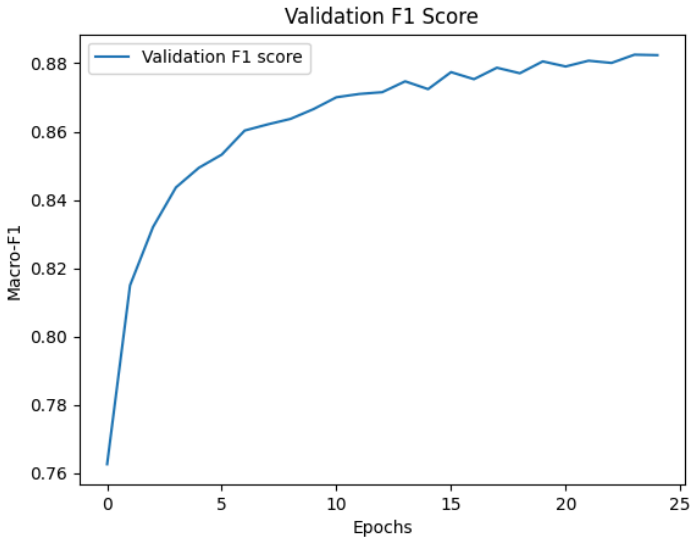


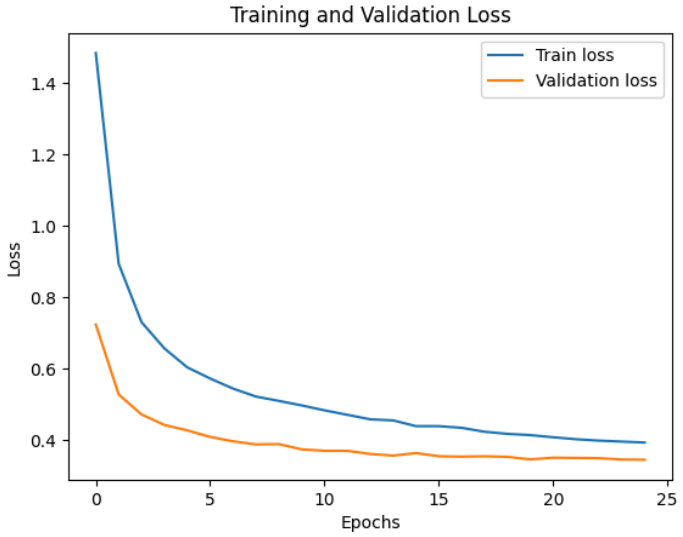
Learning rate = 0.0005

```
Loss: 0.3933, Val Loss: 0.3450, Train Acc: 0.9071, Val Acc: 0.8824, Val
F1: 0.8824
```




Confusion Matrix
Actual
Predicted
0 845 2 9 22 5 2 104 0 11 0
1 4 959 6 23 5 0 1 0 2 0
2 21 0 817 8 89 0 54 1 10 0
3 23 5 11 888 33 1 33 0 5 1
4 0 0 128 29 776 0 65 0 2 0
5 0 0 0 0 0 950 0 31 2 17
6 157 1 117 26 66 0 615 0 17 1
7 0 0 0 0 0 21 0 961 0 18
8 3 1 0 4 2 3 7 5 975 0
9 0 0 0 0 0 7 1 49 0 943
0 1 2 3 4 5 6 7 8 9
800
600
400
200
0


Validation F1 Score
Validation F1 score
Macro-F1
Epochs
0.88
0.86
0.84
0.82
0.80
0.78
0.76
0
5
10
15
20
25


Training and Validation Loss
Train loss
Validation loss
Loss
Epochs
1.4
1.2
1.0
0.8
0.6
0.4
0
5
10
15
20
25

Independent Test Set Results for best Model :

Number of layers = 5
Dropout rate = 0.4
Number of epochs = 25
Neurons in each layer = 256, 128, 64, 32, 16
Learning rate = 0.003

```
Evaluating model on test set...
Test Accuracy: 0.8801, Test F1 Score: 0.8793
Saving confusion matrix...
Saving the model...
Process complete!
```