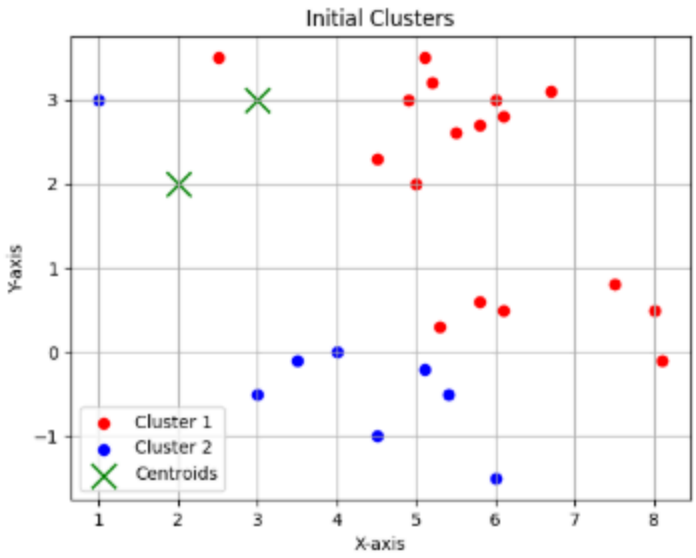
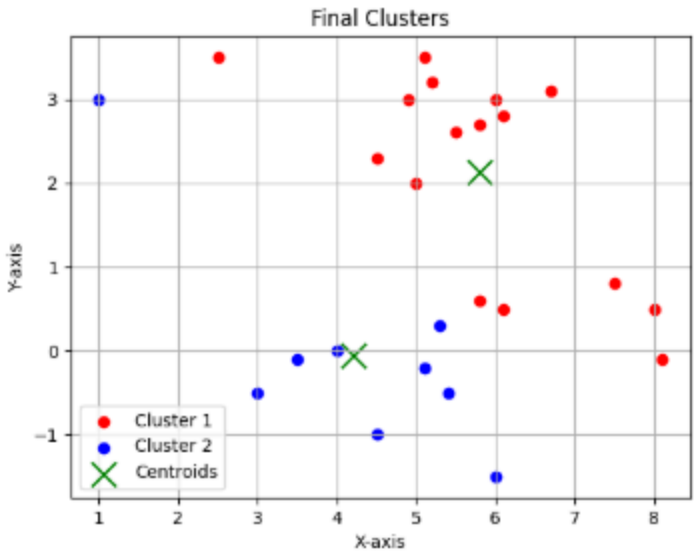
ML Assignment 4 Report

Question 1: Theory (attached)

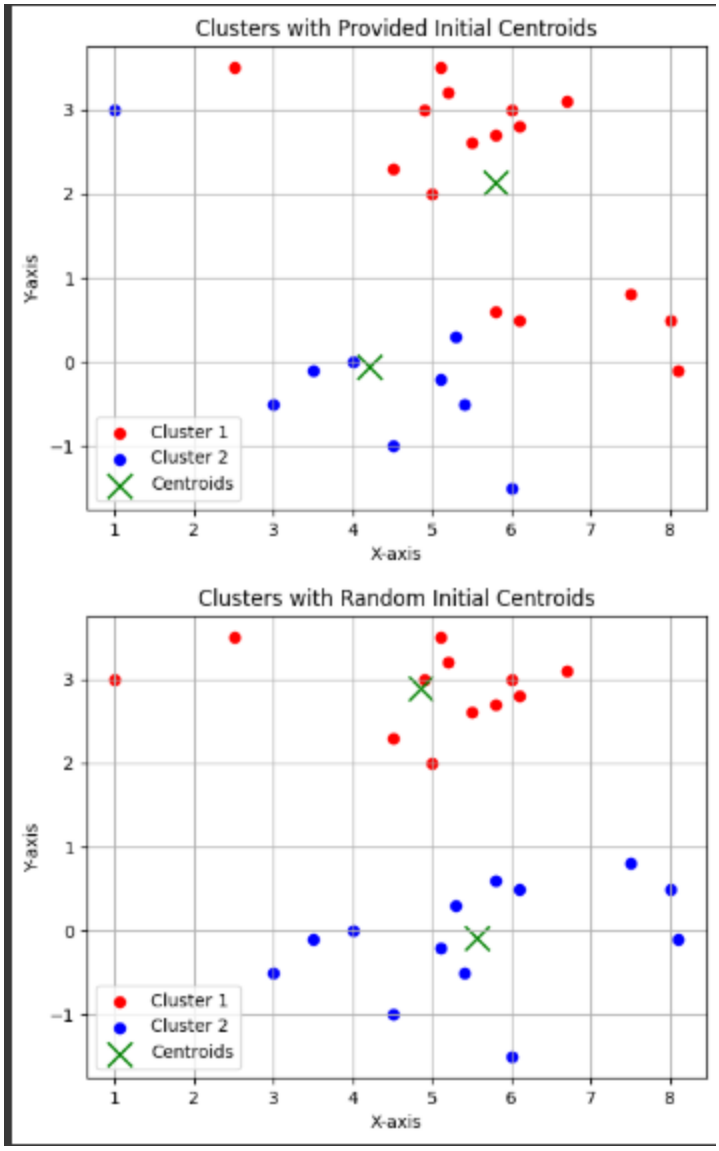
Question 2:

```
Centroids at the end:
Centroid 1: [5.8, 2.125]
Centroid 2: [4.199999999999999, -0.05555555555555555]
clustersss:
Cluster 1: [[5.1, 3.5], [4.9, 3.0], [5.8, 2.7], [6.0, 3.0], [6.7, 3.1], [4.5, 2.3], [6.1, 2.8], [5.2, 3.2], [5.5, 2.6], [5.0, 2.0], [8.0, 0.5], [7.5, 0.8], [8.1, -0.1], [2.5, 3.5], [6.1, 0.5], [5.8, 0.6]]
Cluster 2: [[1.0, 3.0], [4.5, -1.0], [3.0, -0.5], [5.1, -0.2], [6.0, -1.5], [3.5, -0.1], [4.0, 0.0], [5.4, -0.5], [5.3, 0.3]]
```





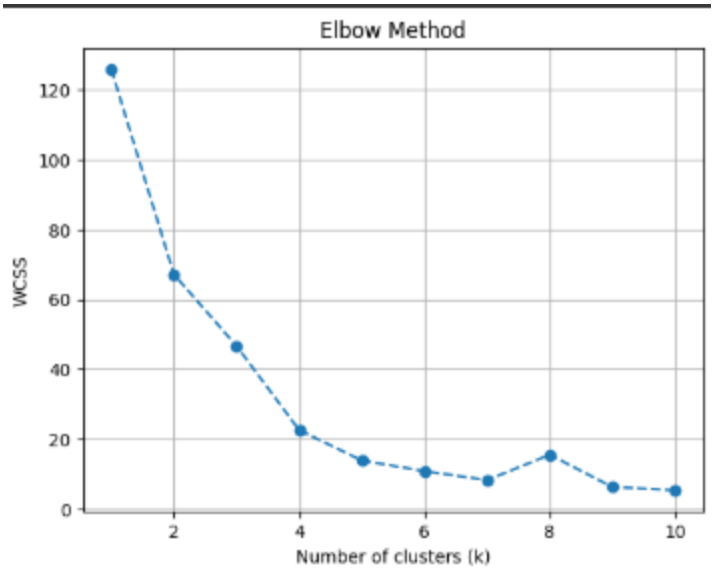

```
Final Centroids:
Centroid 1: [5.8, 2.125]
Centroid 2: [4.199999999999999, -0.05555555555555555]
```

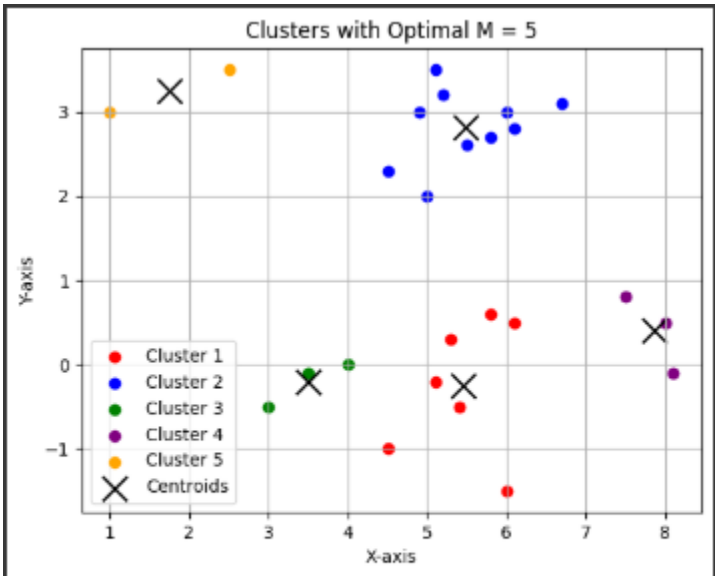


The randomly assigned centroids clustered the points better.

```
Results with Provided Initial Centroids:
Centroid 1: [5.8, 2.125]
Centroid 2: [4.199999999999999, -0.05555555555555555]

Results with Random Initial Centroids:
Centroid 1: [4.858333333333333, 2.891666666666667]
Centroid 2: [5.561538461538461, -0.09230769230769233]
```



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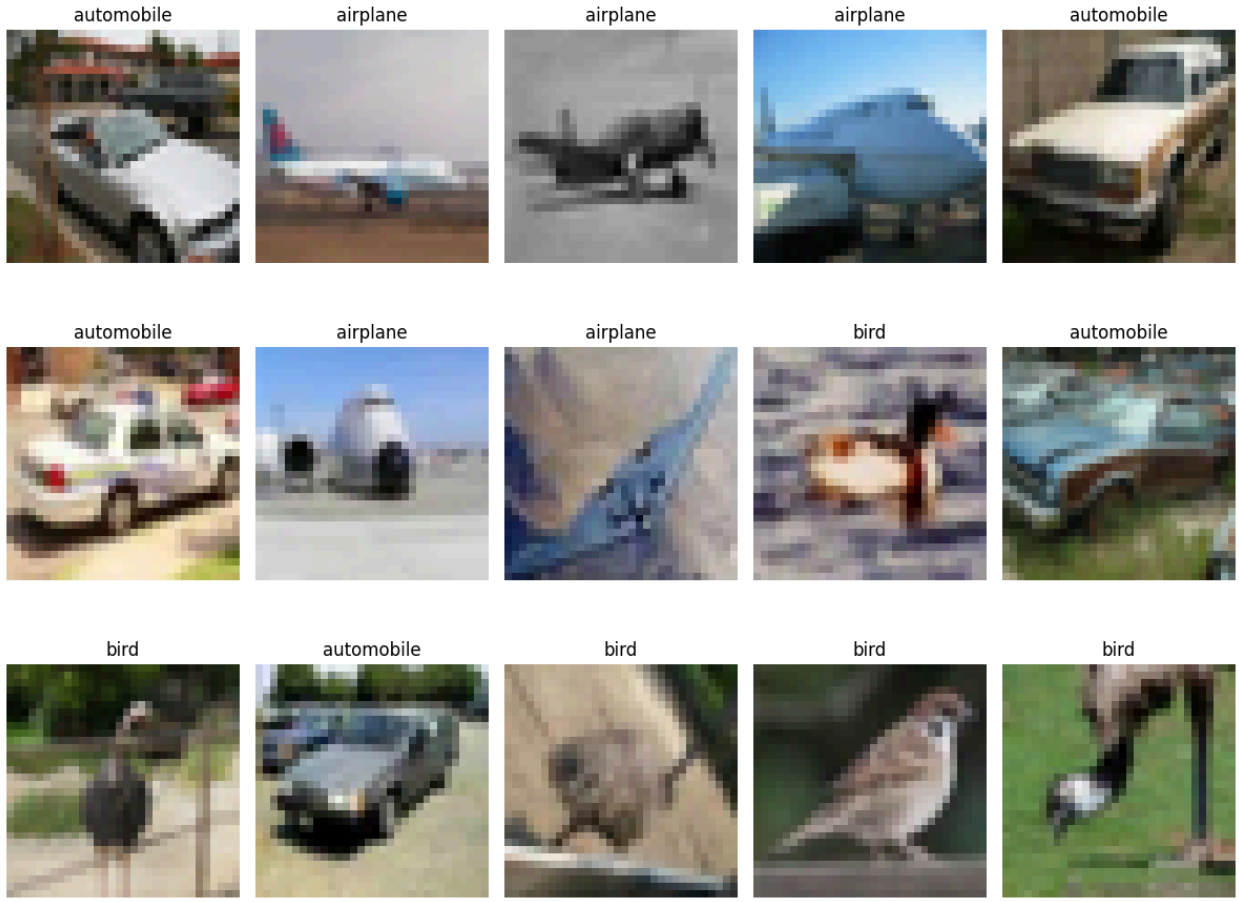
Final Centroids with Optimal Clusters:
Centroid 1: [5.457142857142856, -0.2571428571428572]
Centroid 2: [5.48, 2.82]
Centroid 3: [3.5, -0.19999999999999998]
Centroid 4: [7.866666666666667, 0.39999999999999997]
Centroid 5: [1.75, 3.25]
```

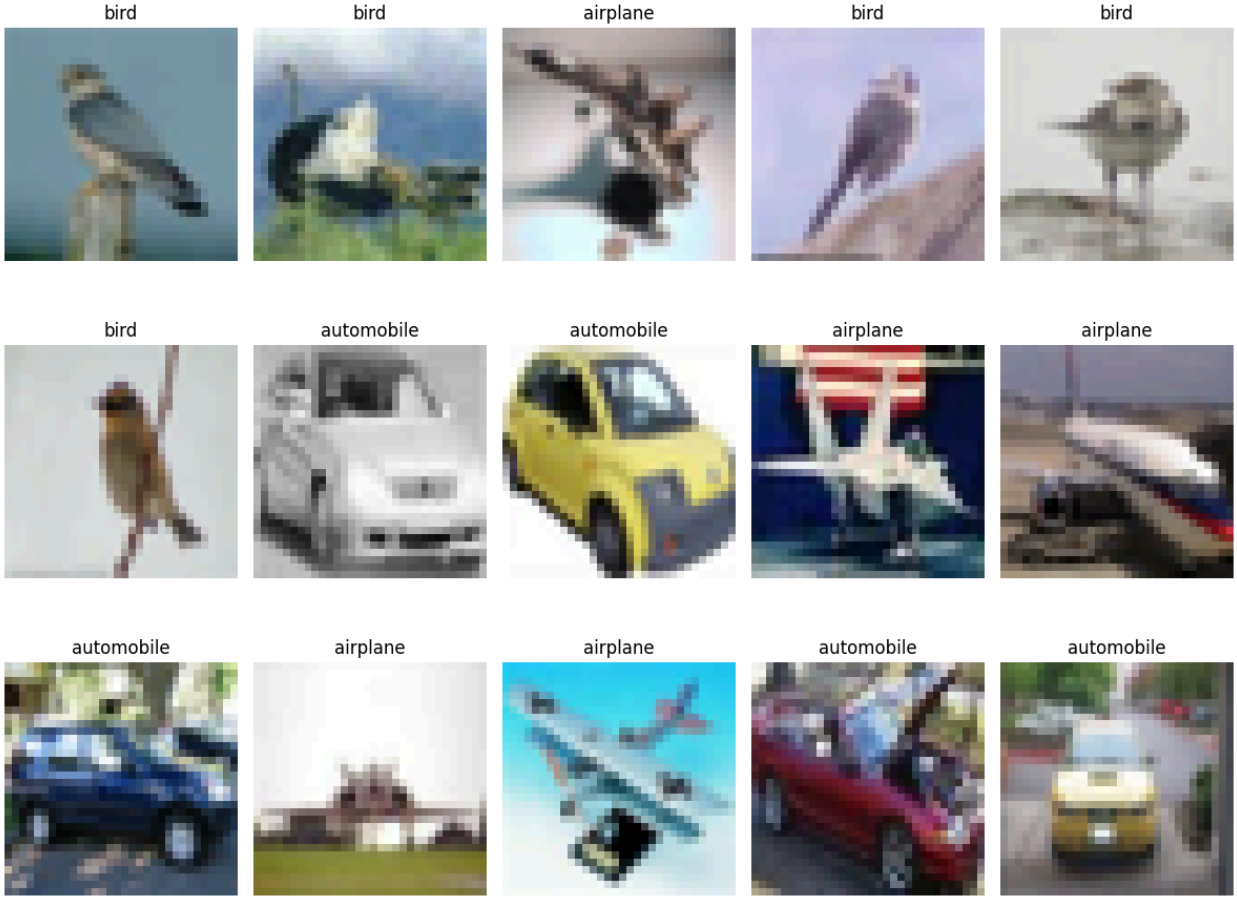
Question 3:

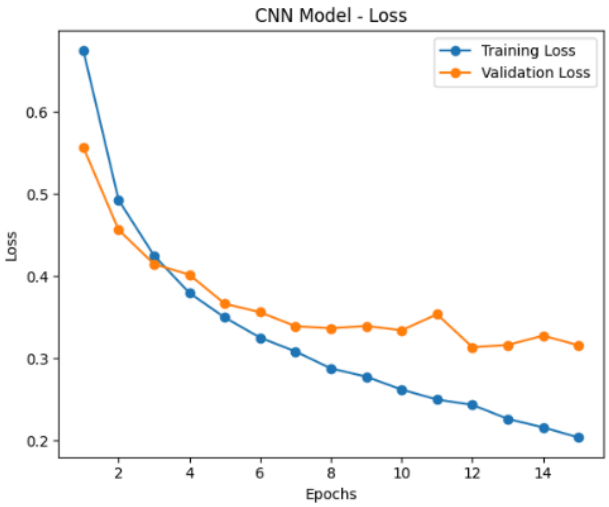
```
Train data size: 12000
Validation data size: 3000
Test data size: 3000
```

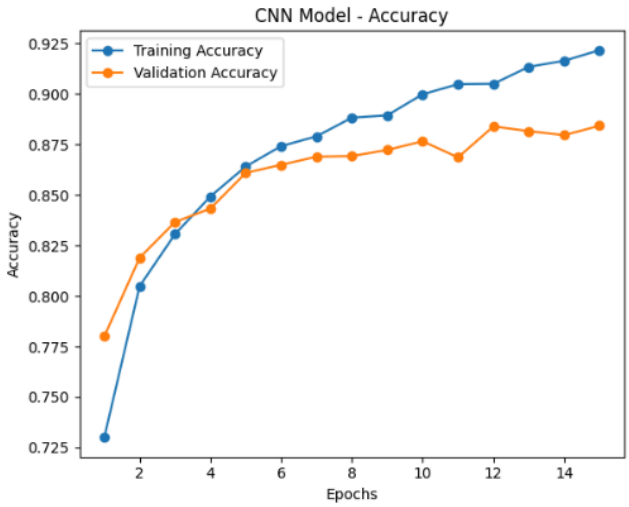
trainn-5 imagesssssss



Validation Dataset 5 imagess

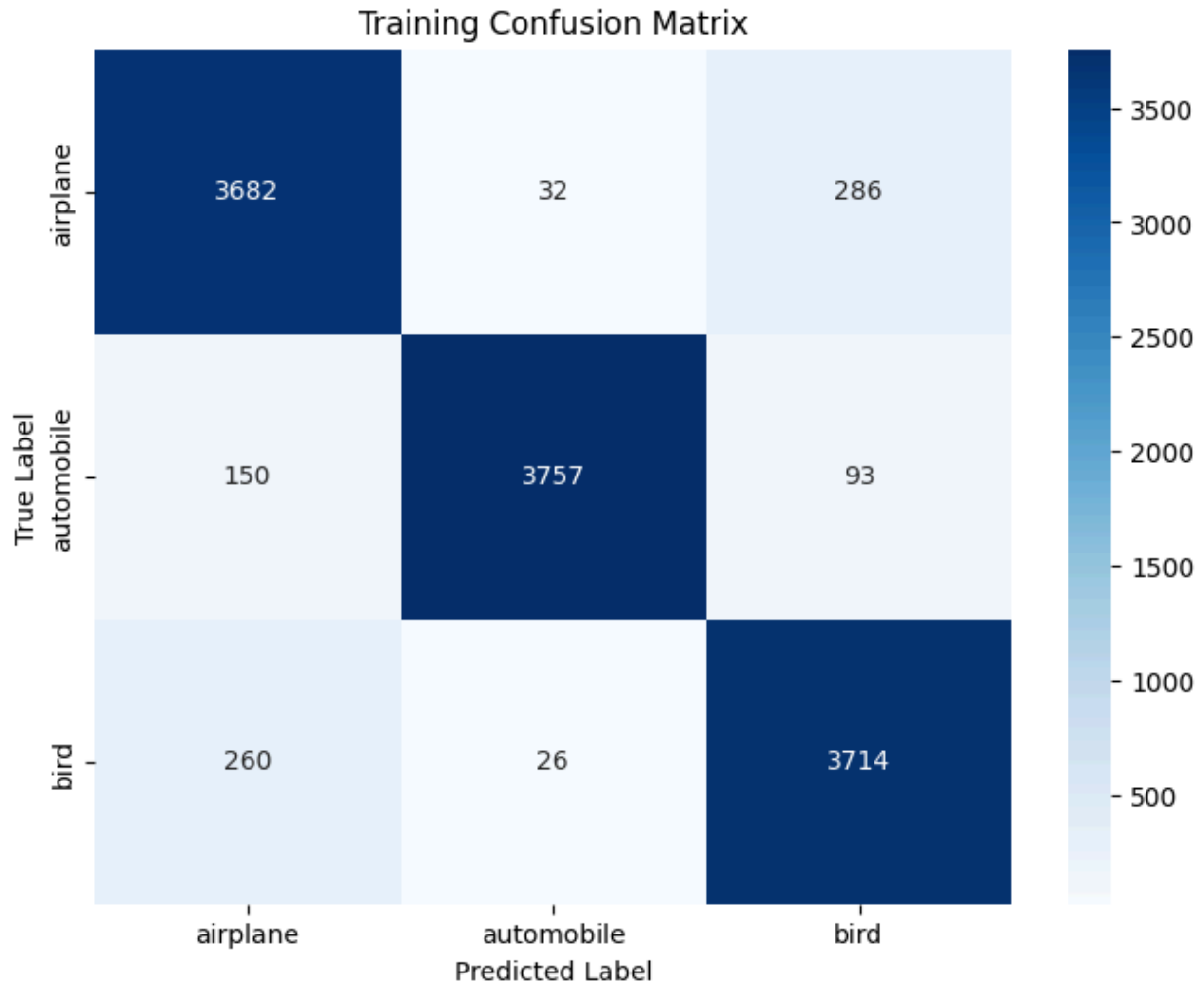


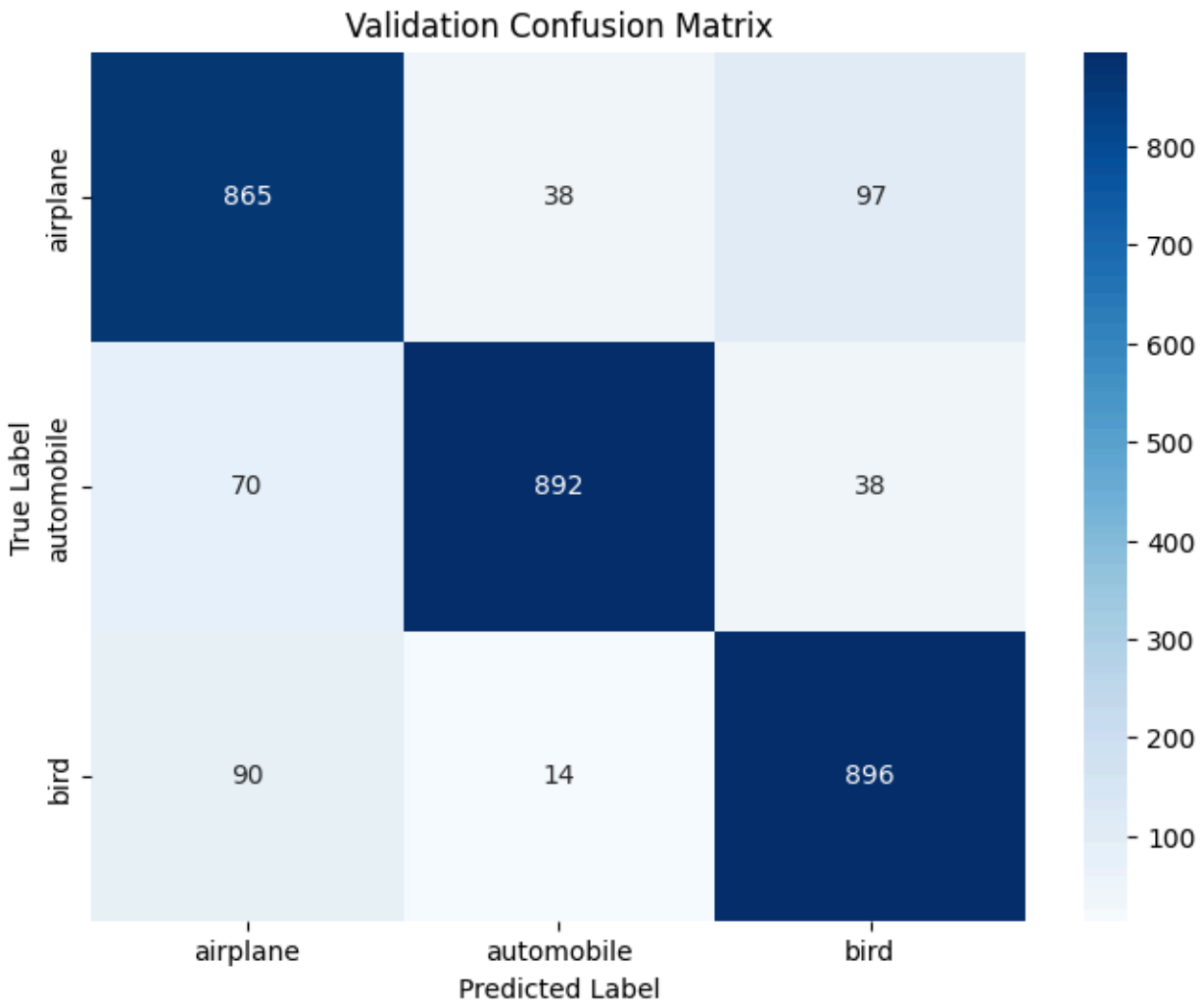


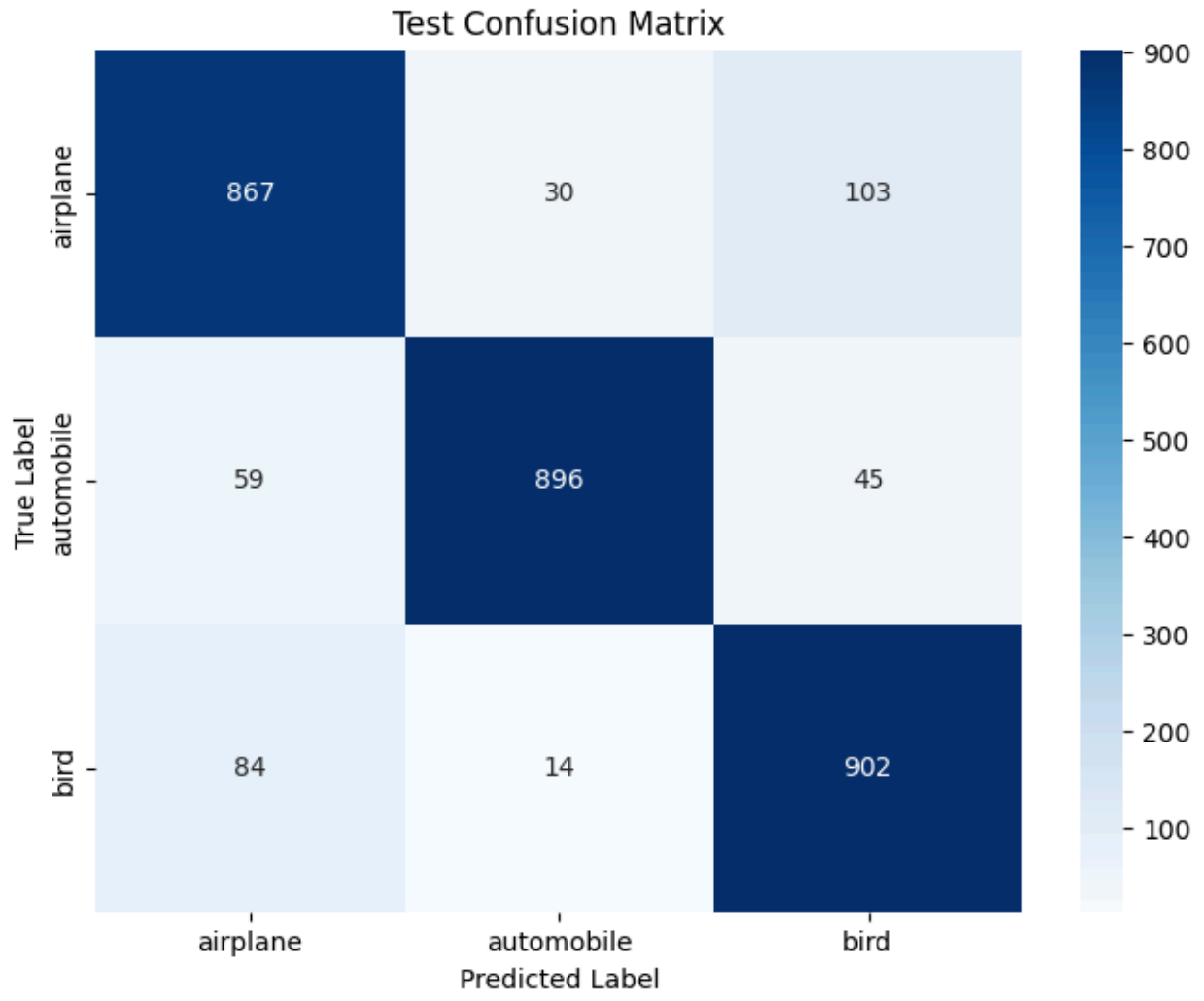


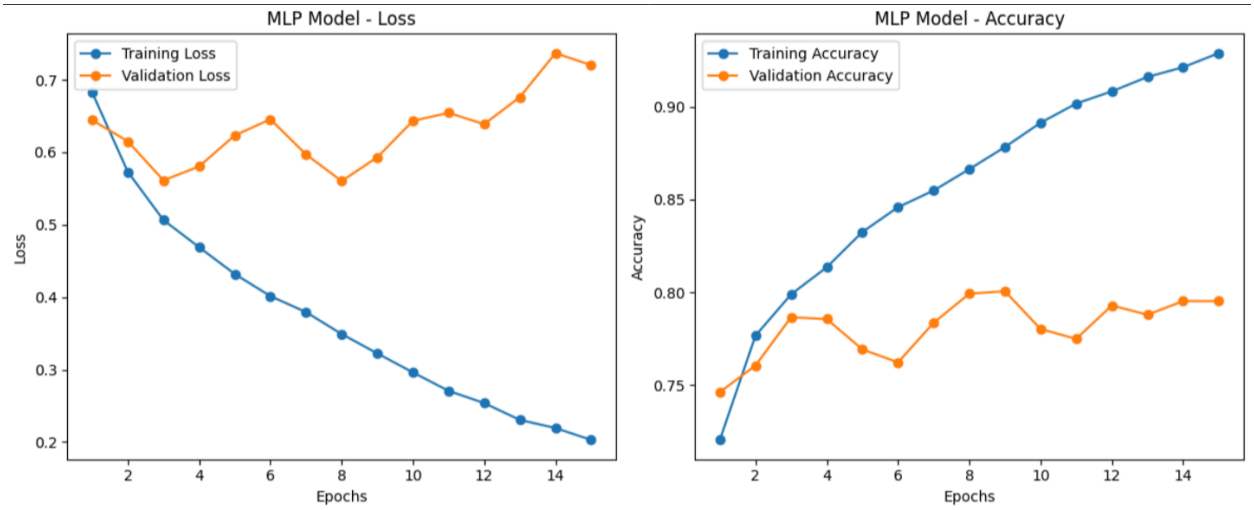
For the CNN model:

```
Training Accuracy: 0.9294, F1-Score: 0.9298
Validation Accuracy: 0.8843, F1-Score: 0.8848
Test Accuracy: 0.8883, F1-Score: 0.8888
```



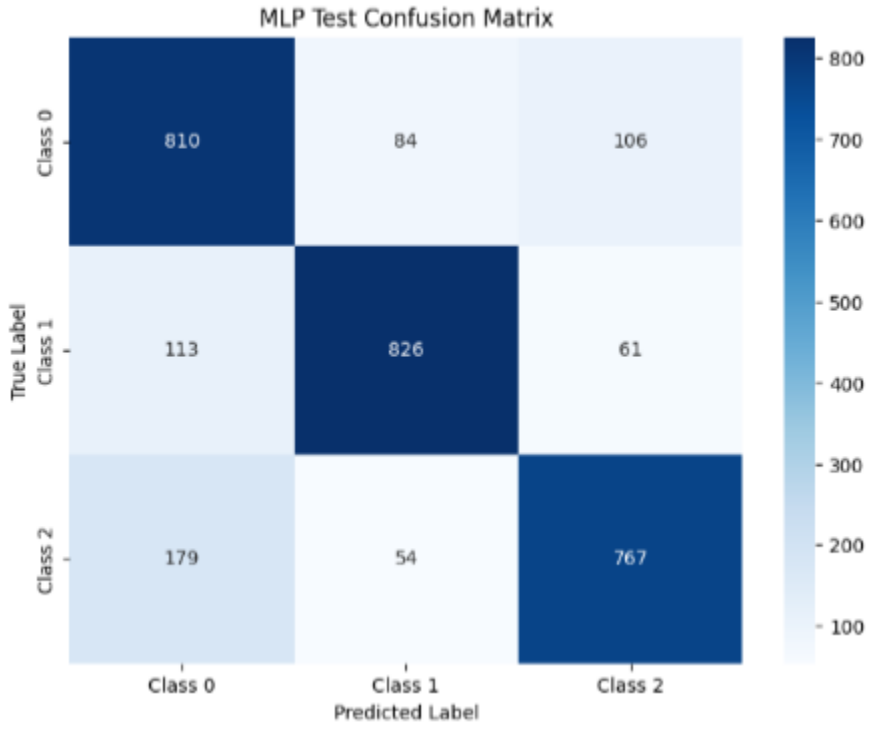

Validation Confusion Matrix
True Label
airplane
automobile
bird
865
38
97
70
892
38
90
14
896
airplane
automobile
bird
Predicted Label
800
700
600
500
400
300
200
100


Test Confusion Matrix
867
30
103
59
896
45
84
14
902
airplane
automobile
bird
True Label
airplane
automobile
bird
Predicted Label
900
800
700
600
500
400
300
200
100

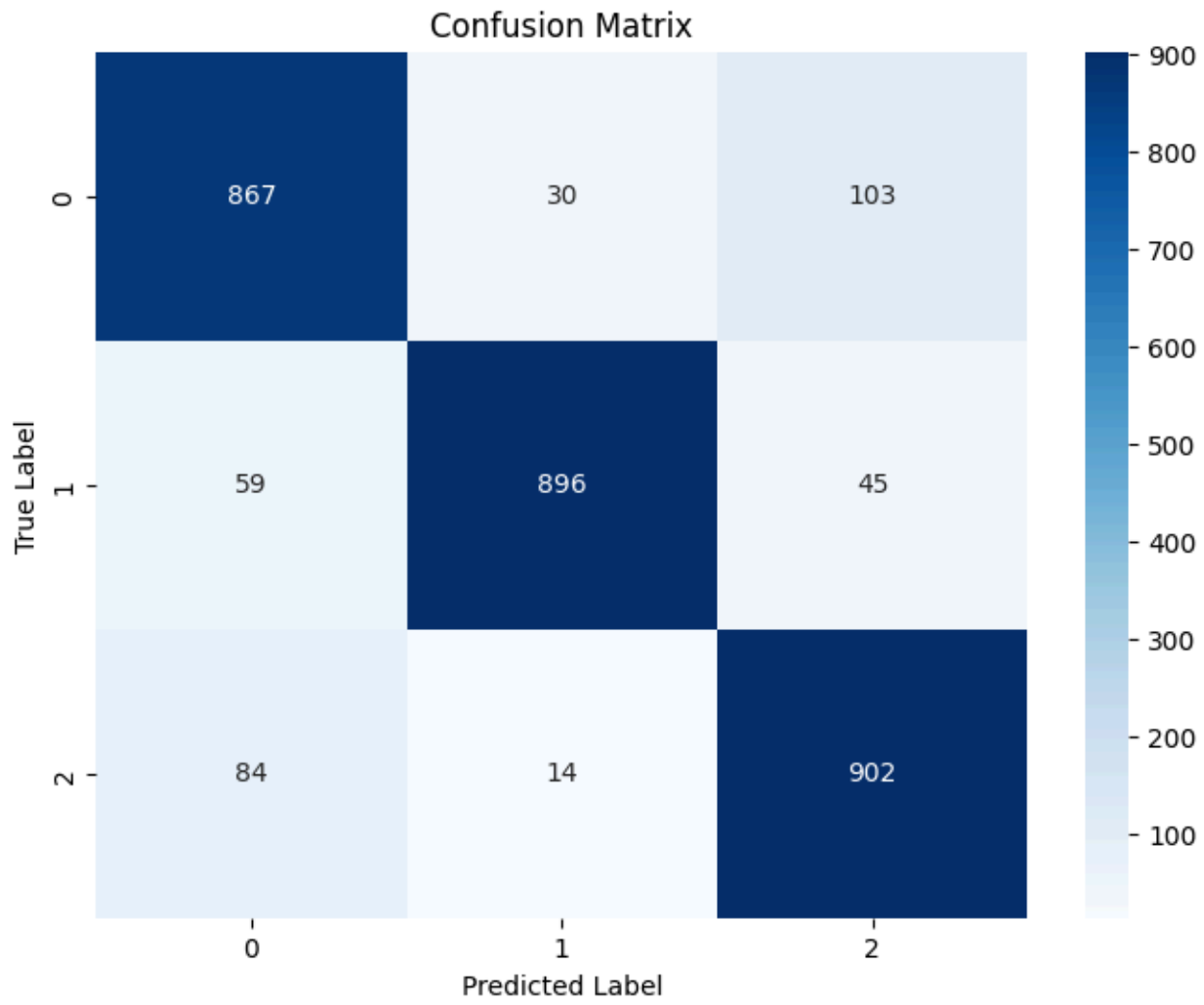

MLP Model - Loss
Training Loss
Validation Loss
Loss
Epochs
MLP Model - Accuracy
Training Accuracy
Validation Accuracy
Accuracy
Epochs

For the MLP model:

```
Test Accuracy: 0.8010
Test F1-Score: 0.8017
```

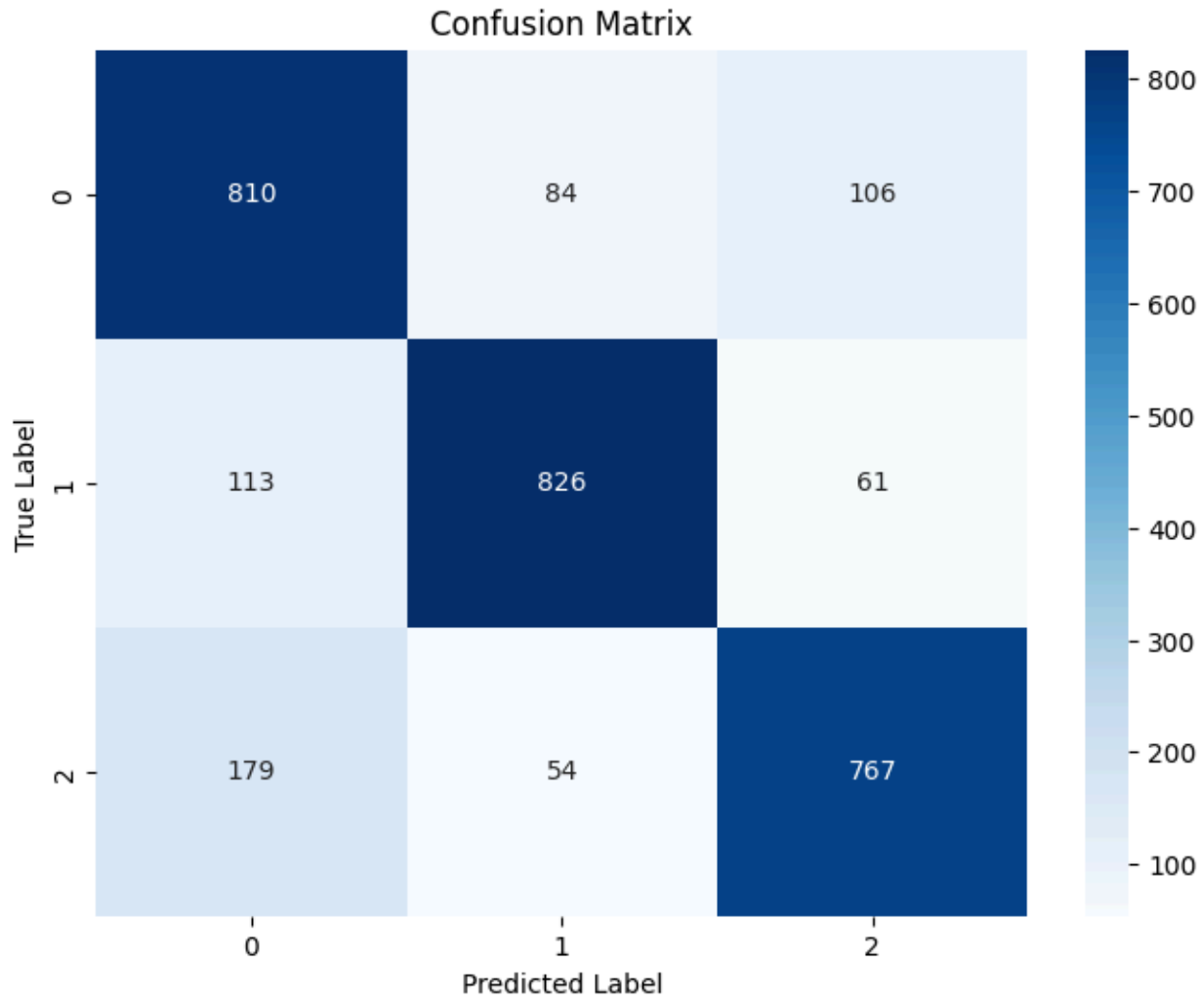


Evaluation of the CNN model:




```
CNN Test Accuracy: 0.8883
CNN F1-Score: 0.8888
```

For evaluating the MLP model:




```
MLP Test Accuracy: 0.8010
MLP F1-Score: 0.8017
```