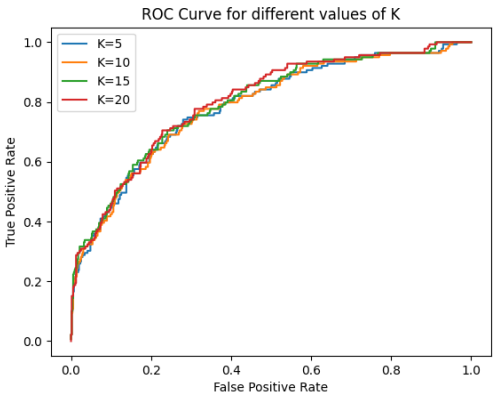
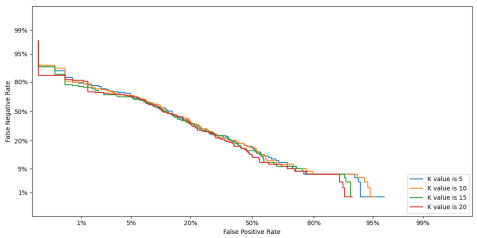
1 K-Means and Gaussian Mixture Models

Aim: To perform classification of the data using K-means and Gmm.

1.1 Image Data





Inferences:

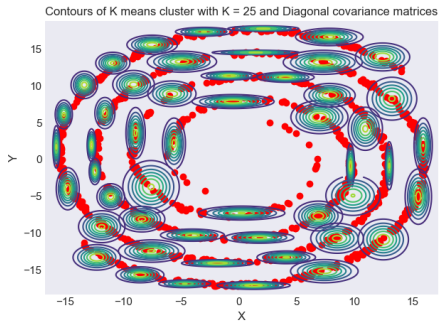
- In Kmeans clusters both diagonal and Non diagonal covariance matrices have same accuracy as distance is independent of covariance matrix.
- In GMM clusters Non diagonal covariance matrices give much more accuracy compared to diagonal covariance matrices.

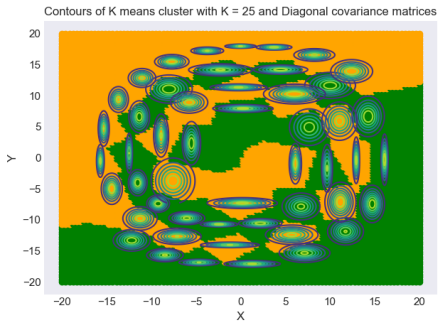
1.2 Synthetic Data

1.2.1 Plots for K-means clusterring for different value of k's :

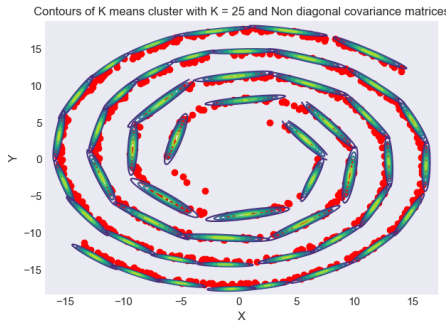
For k=25:

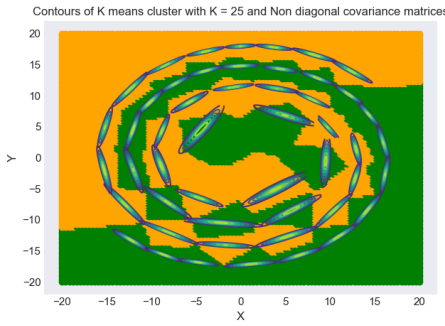
- **For Diagonal covaraince matrices:**





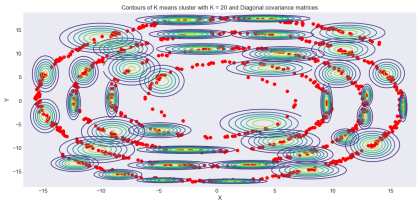
- **For Non-Diagonal covaraince matrices:**

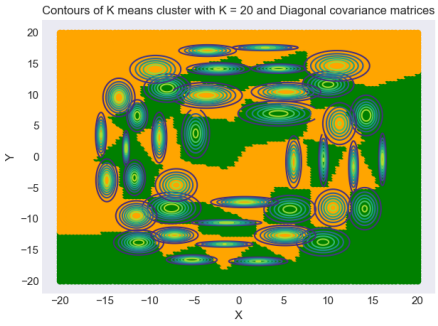




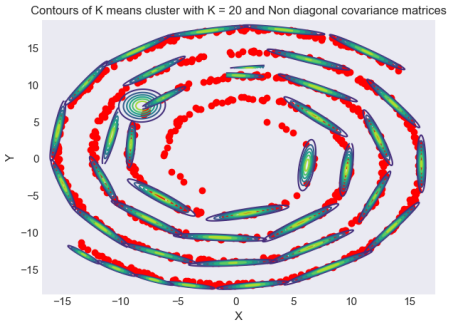
For k=20:

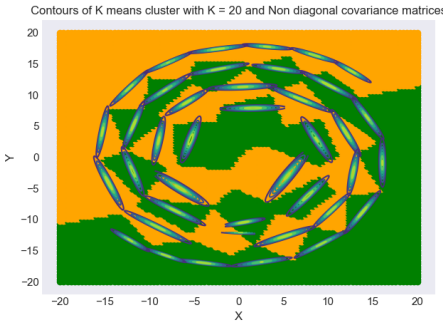
- **For Diagonal covaraince matrices:**





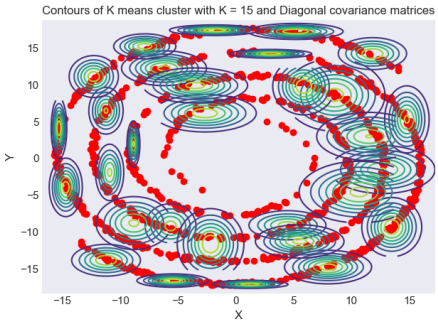
- **For Non-Diagonal covaraince matrices:**

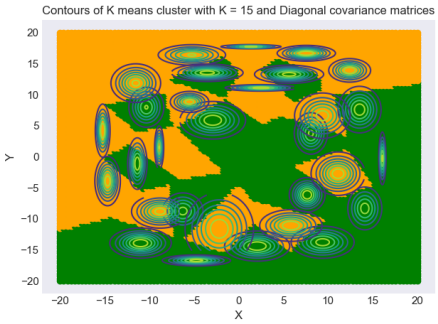




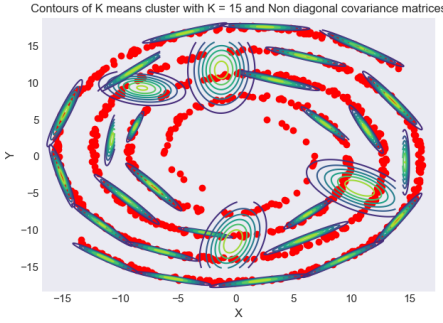
For k=15:

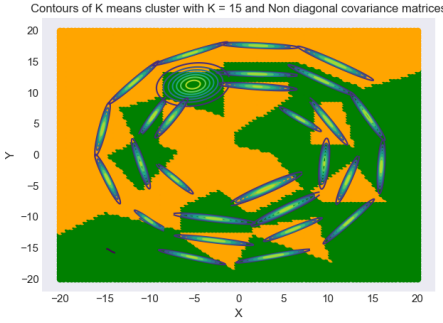
- **For Diagonal covaraince matrices:**



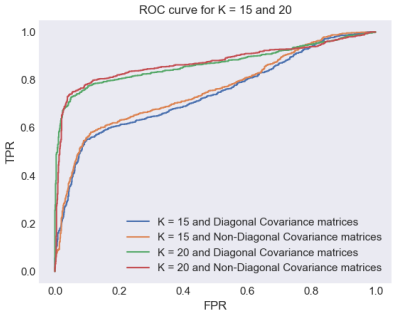


- **For Non-Diagonal covaraince matrices:**



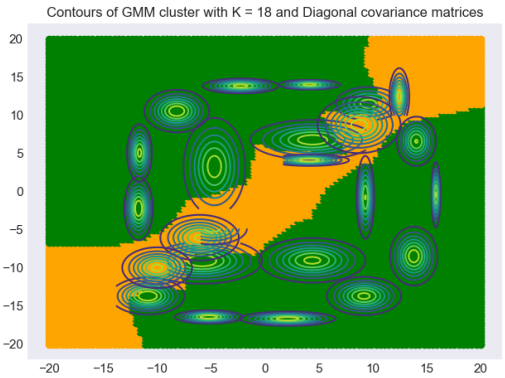


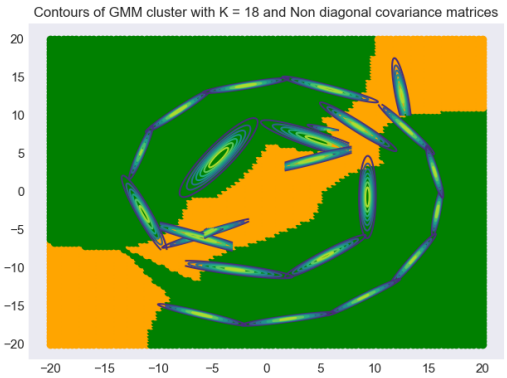
- **ROC and DET Curves:**



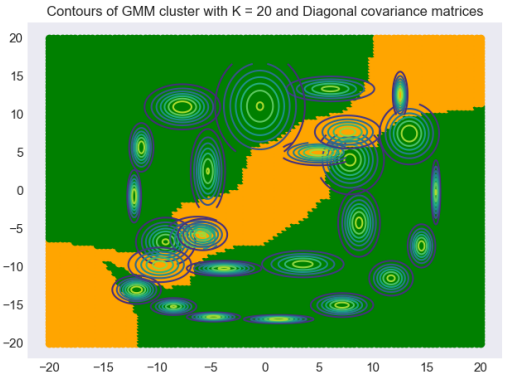
2 GMM:

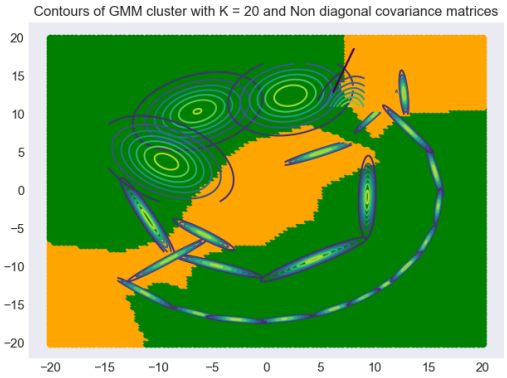
For k=18



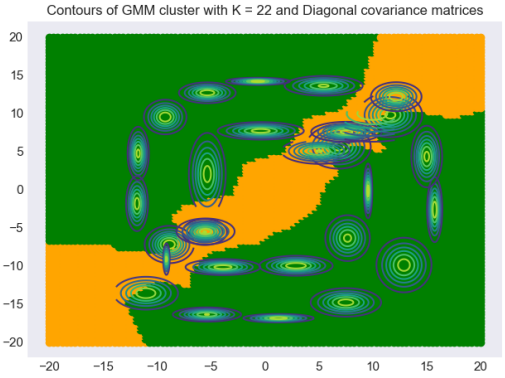


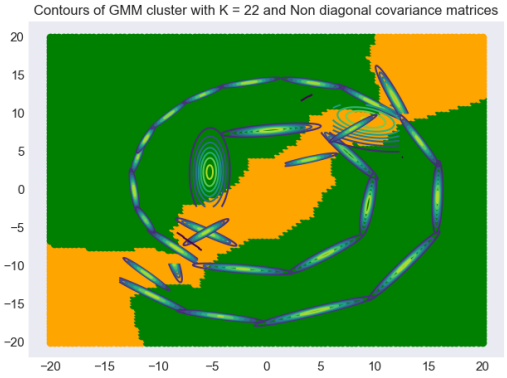
For k=20



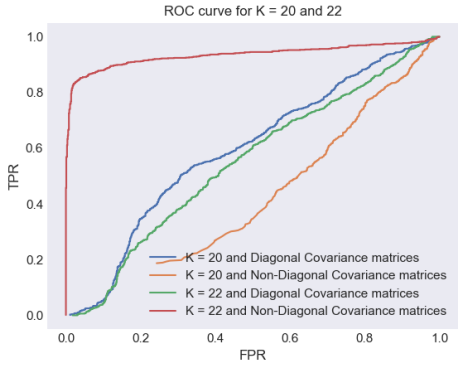


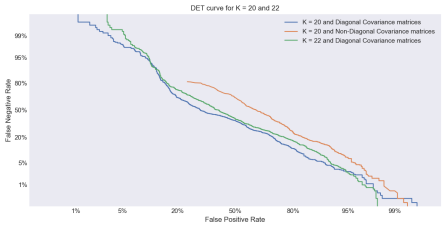
For k=22





ROC and DET Curves:





Inferences:

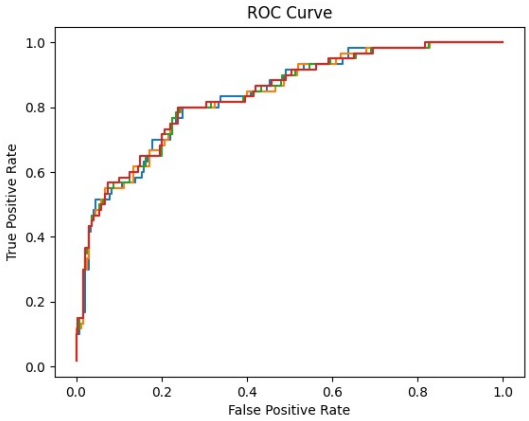
- For higher value of k (number of clusters) we get higher classification accuracy.
- Non diagonal covariance matrix will have better accuracy than diagonal covariance matrix because on making the non-diagonal entries as zero will be removed so the accuracy will get reduced.

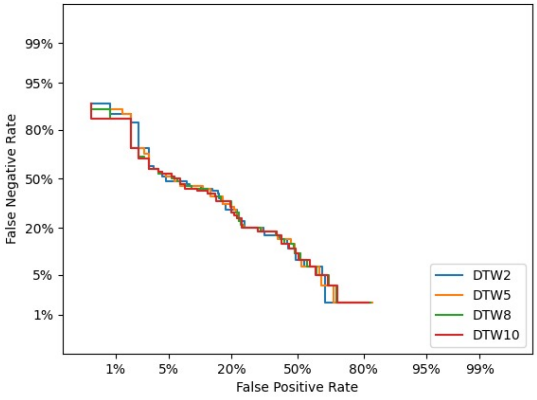
3 DTW and Discrete HMM

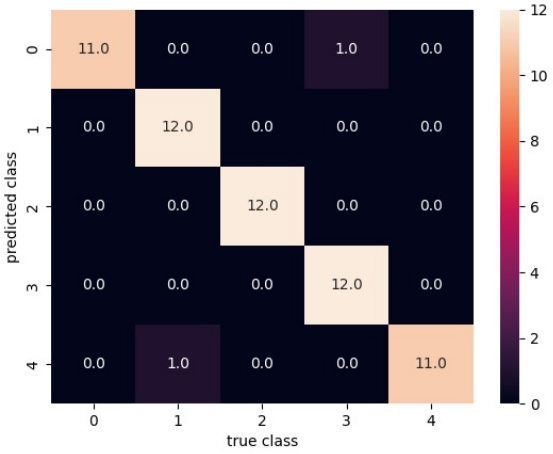
3.1 DTW

- Here we are given two sets of data
  1. Spoken digits
  2. Hand-written data
- For two sets we do dtw in a similar way, for every development point we take dtw algorithm with every training data point and consider the average of top k (least k distances).
- we will classify the taken development point to a class which is nearest to the training point which is obtained in the above step.
- We take scores as average of the distances and plot ROC and DET using them

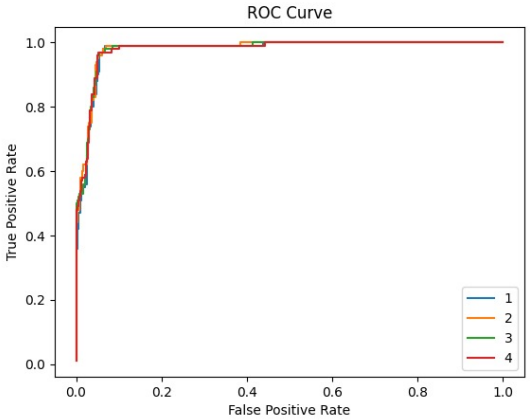
ROC curve,DET curve,Confusion matrices for hand-written data

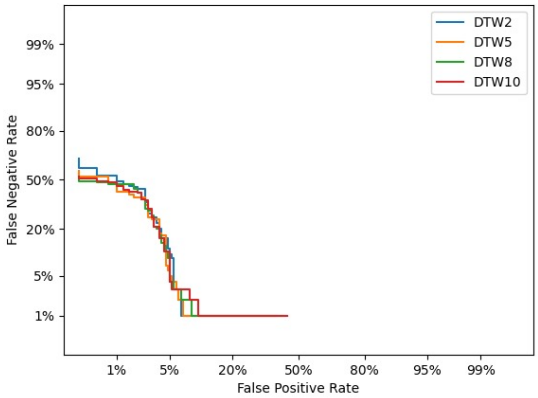




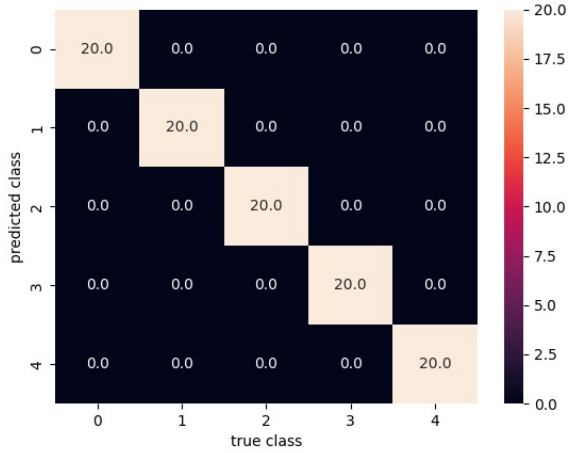


3.2 ROC curve,DET curve,Confusion matrices for spoken digits



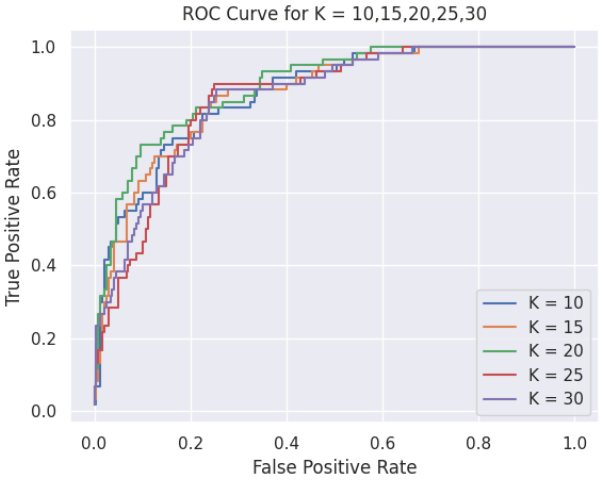


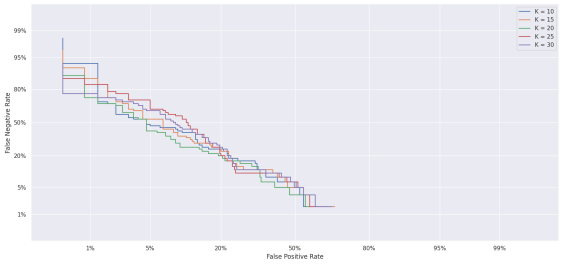
- Accuracy for recognising the data(hand written) is coming 100 percent for the value k=5 clusters.

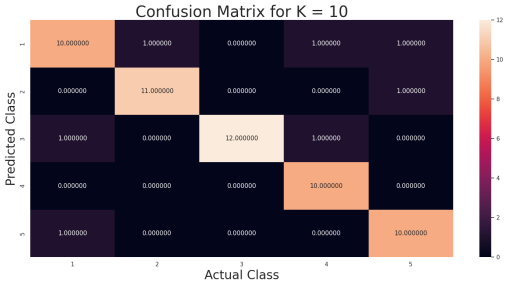


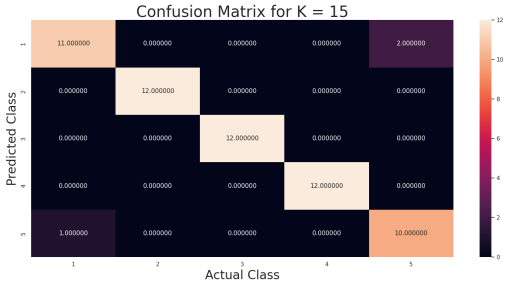
4 HMM

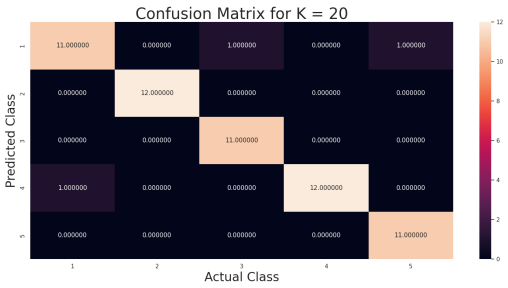
4.1 voice data

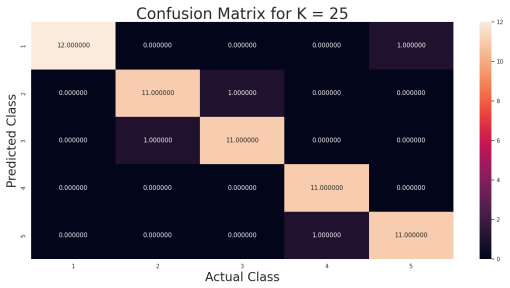


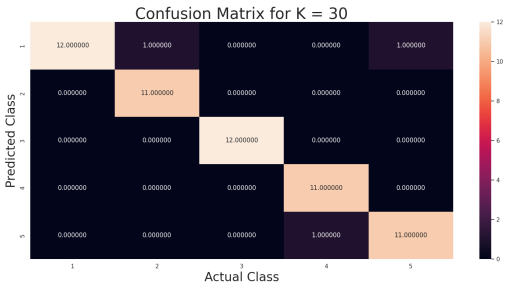




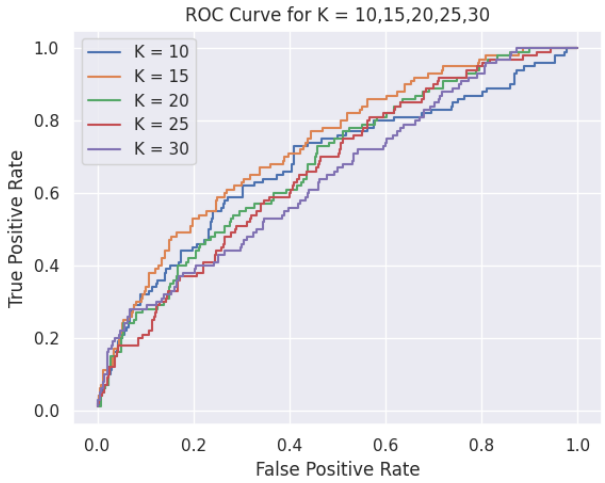


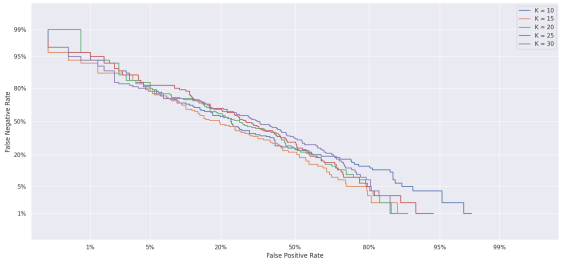


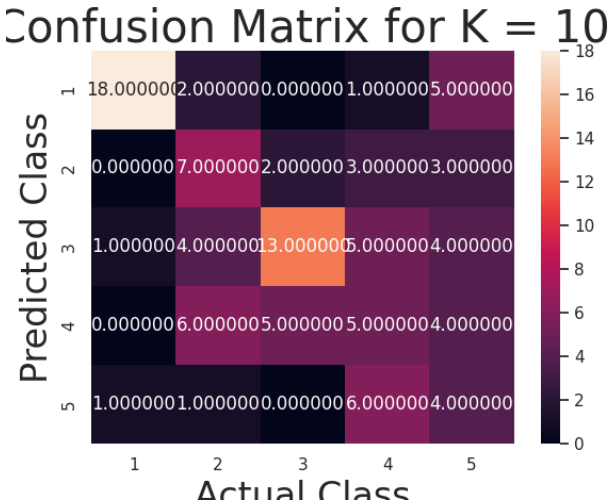


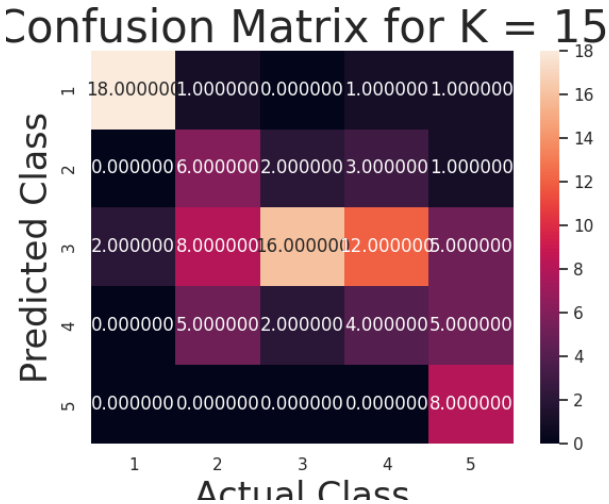


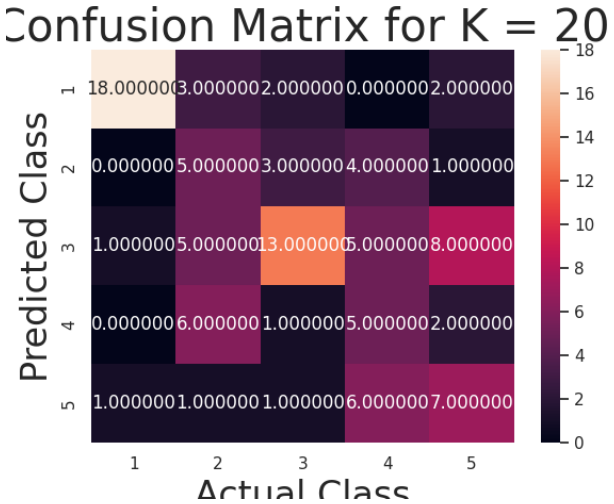
4.2 Hand Written Characters

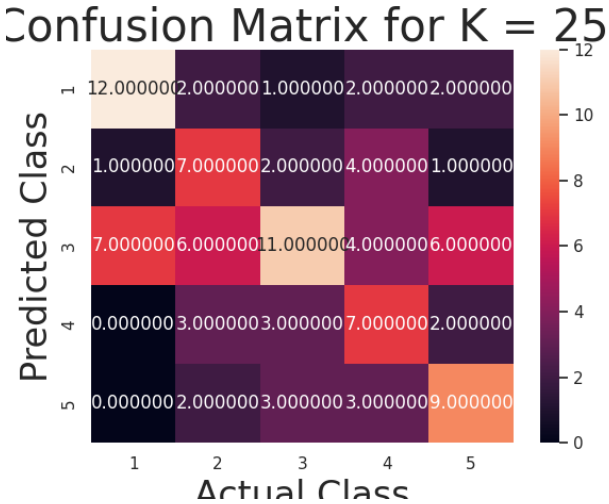


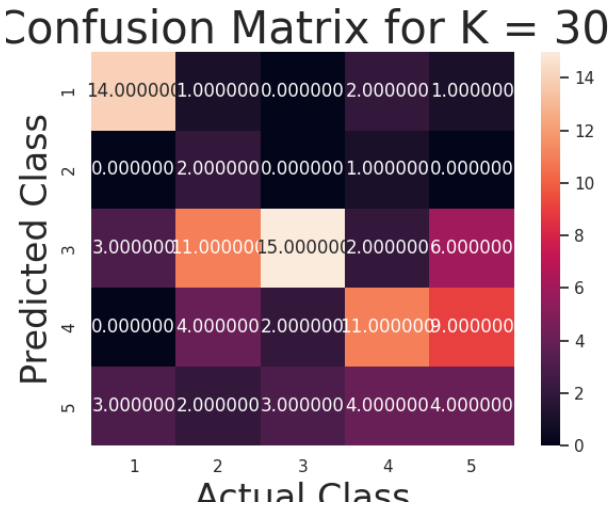











Confusion Matrix for K = 30
Predicted Class
Actual Class
1
2
3
4
5
14.000000
1.000000
0.000000
2.000000
1.000000
0.000000
2.000000
0.000000
1.000000
0.000000
3.000000
11.000000
15.000000
2.000000
6.000000
0.000000
4.000000
2.000000
11.000000
9.000000
3.000000
2.000000
3.000000
4.000000
4.000000
14
12
10
8
6
4
2
0