ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

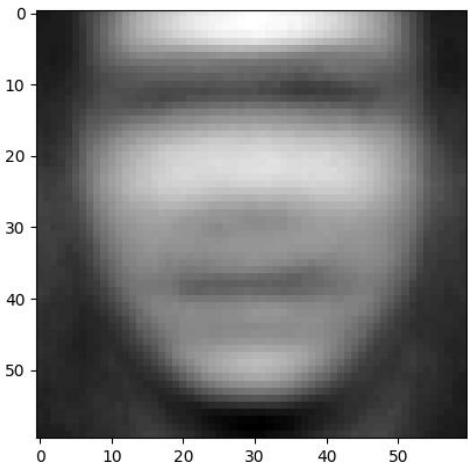
Dataset Used: http://www.umdfaces.io/ (I've used Batch 3)
Data Preprocessing:

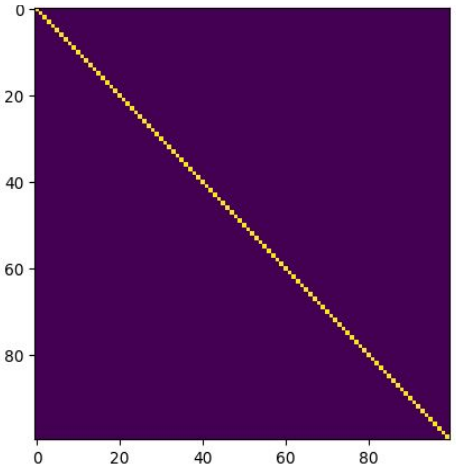
- The dataset comes with a separate csv file that contains the annotations for all the faces in the dataset.
- I've tried and extracted 1000 face images (grayscale) of 60x60 without repeating face image of the same person.
- To extract the non face images (grayscale) I've used the same 1000 images that I used for face and extracted a patch of 60x60 from the background keeping the iou at a permissible value.
- I've repeated the above two steps to extract 100 test images for face and non face.
- For faster access I've used pickle library to dump the numpy array containing images into a '.p' file.
- Since the feature space is still too big, I've applied PCA to reduce the feature vector from 3600 to 100 and standardized the data to have 0 mean and 1 variance.
- After preprocessing the data, just keep the four dump (.p) files named "train_f.p", "train_nf.p", "test_f.p" and "test_nf.p" in the same folder as the rest of the code for the models to access it.
- To create the dataset dumps run the execute the file cv1_image_processing.py with the value as True in initialize function. Also need to set the dataset path and csv_file path

Model 1 - Single Gaussian:
For Model 1 execution : python3 model_1_2.py single
K = 1

False Positive Rate: 0.28
False Negative Rate: 0.63
Misclassification Error: 0.45

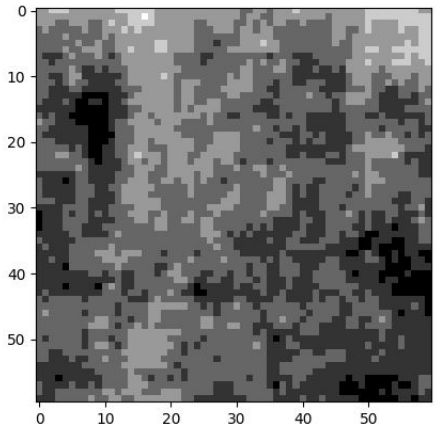
Visualizations for Face Data - Mean and Covariance:

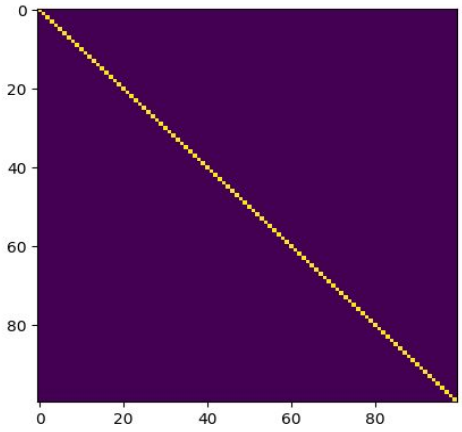




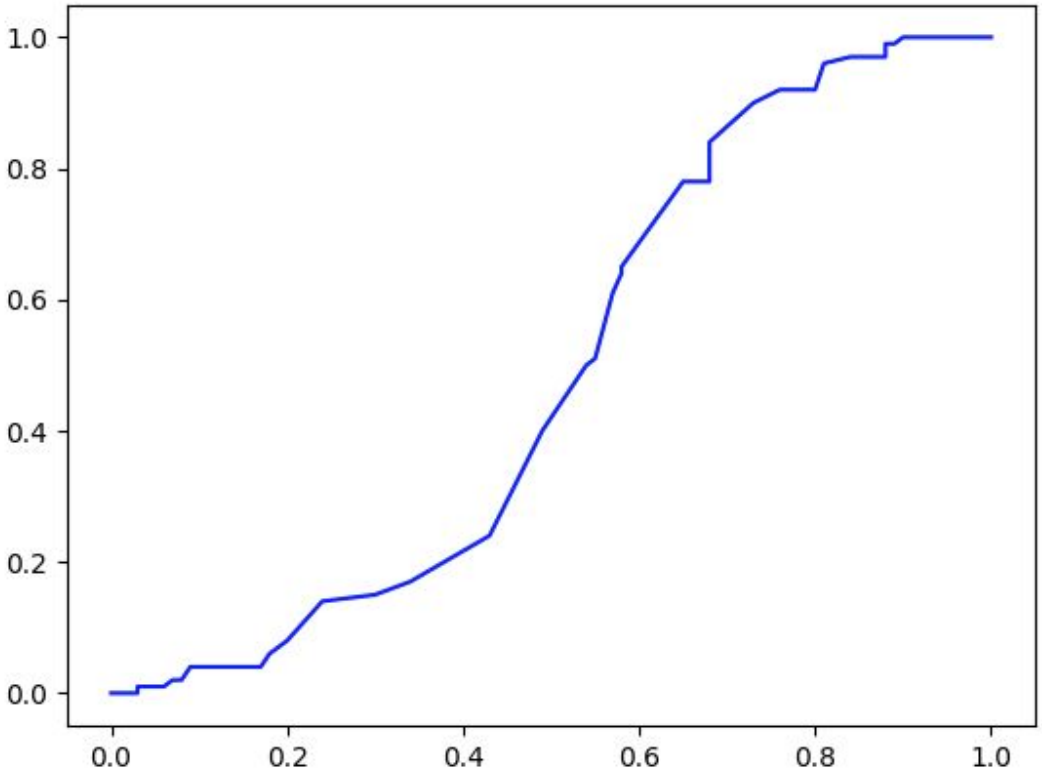
ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

Visualizations for Non Face Data - Mean and Covariance:





ROC Curve:

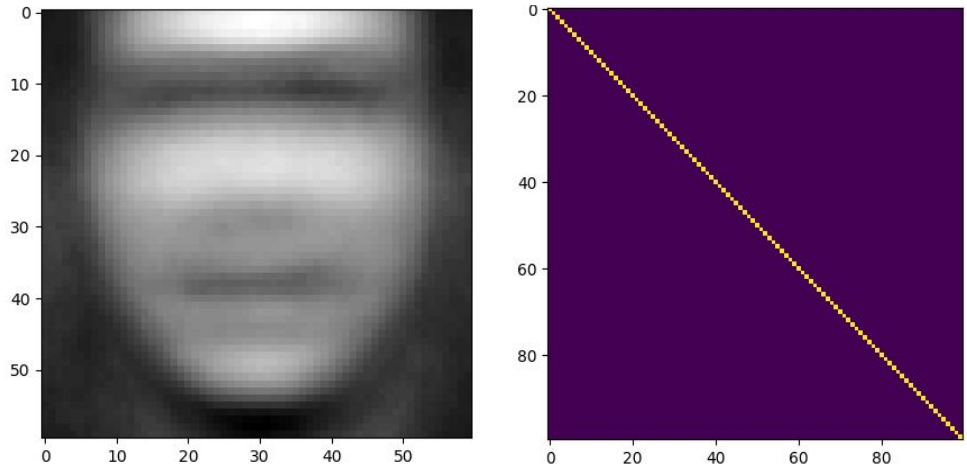


ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

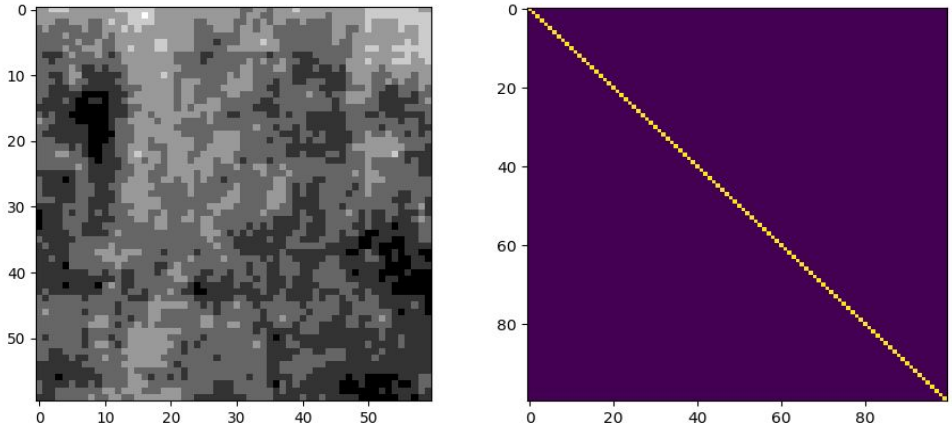
Model 2 - Mixture of Gaussians:
For Model 2 execution : python3 model_1_2.py mixture
K = 3

False Positive Rate: 0.29
False Negative Rate: 0.61
Misclassification Error: 0.45

Visualizations for Face Data - Mean and Covariance:

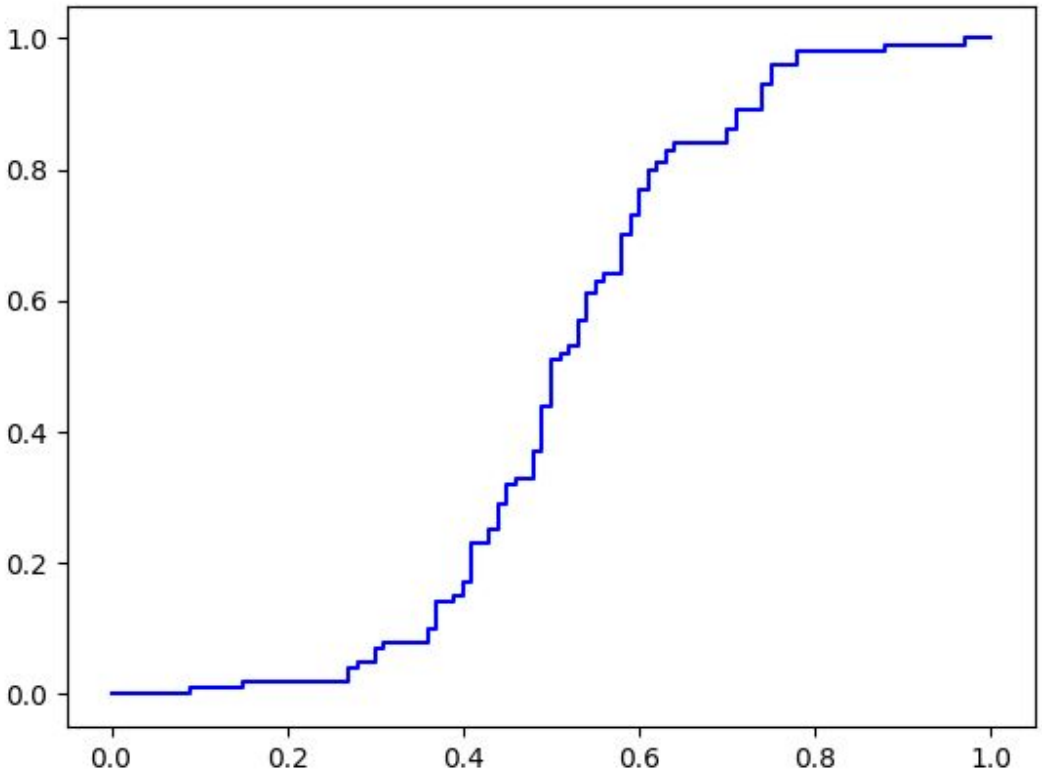


Visualizations for Non Face Data - Mean and Covariance:



ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

ROC Curve:



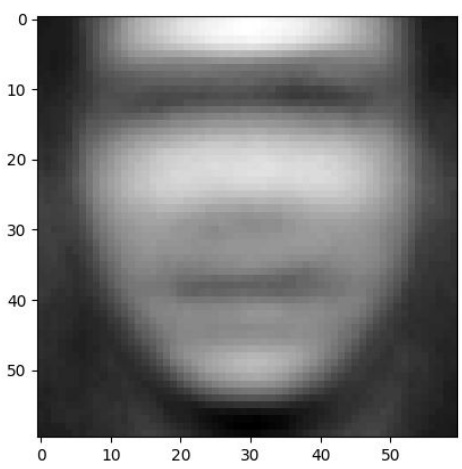
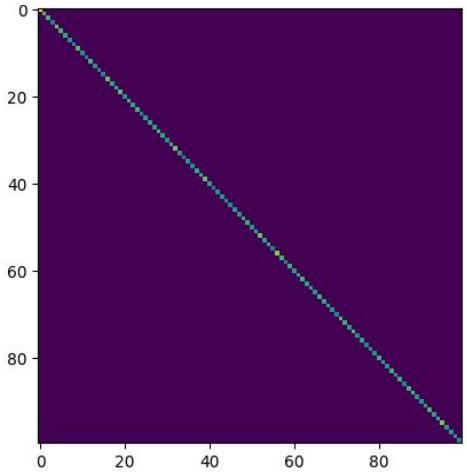
ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

Model 3 - t_Distribution:

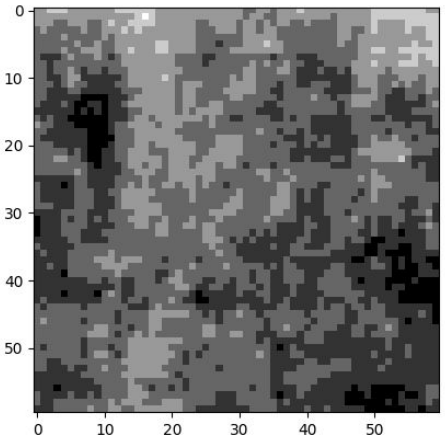
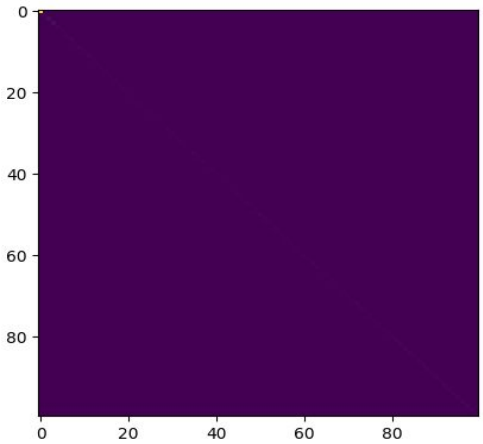
For Model 3 execution : python3 model_3.py

False Positive Rate: 0.22
False Negative Rate: 0.59
Misclassification Error: 0.405

Visualizations for Face Data - Mean and Covariance:

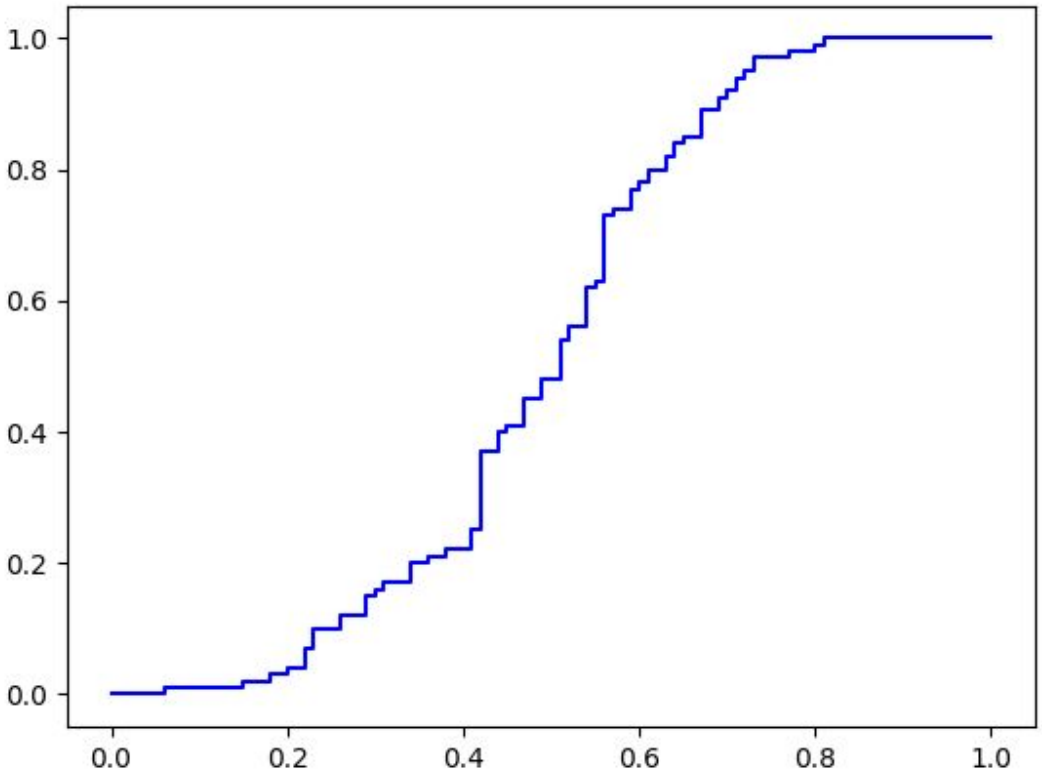
Visualizations for Non Face Data - Mean and Covariance:

The covariance matrix for non face has a very light line in diagonal which can be seen upon zooming the image.

ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

ROC Curve:



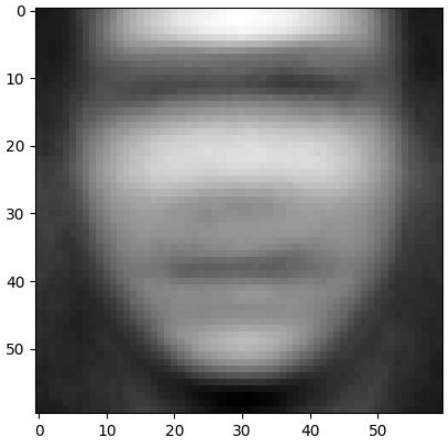
ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

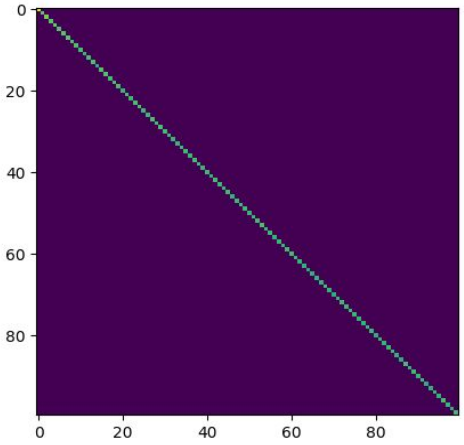
Model 4 - Mixture of t_Distributions:

For Model 4 execution : python3 model_4.py

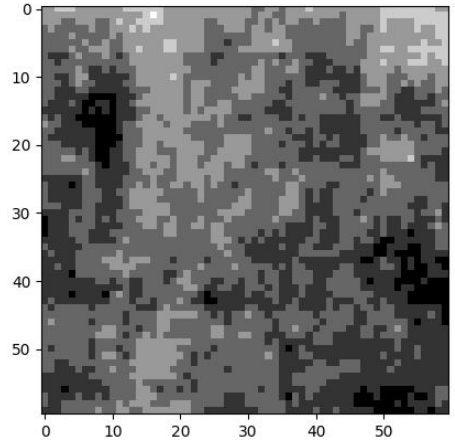
False Positive Rate: 0.28
False Negative Rate: 0.66
Misclassification Error: 0.47

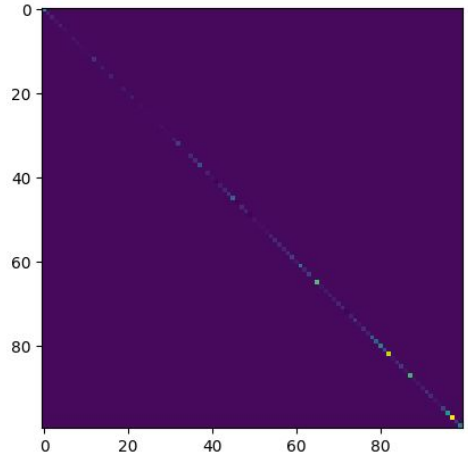
Visualizations for Face Data - Mean and Covariance:





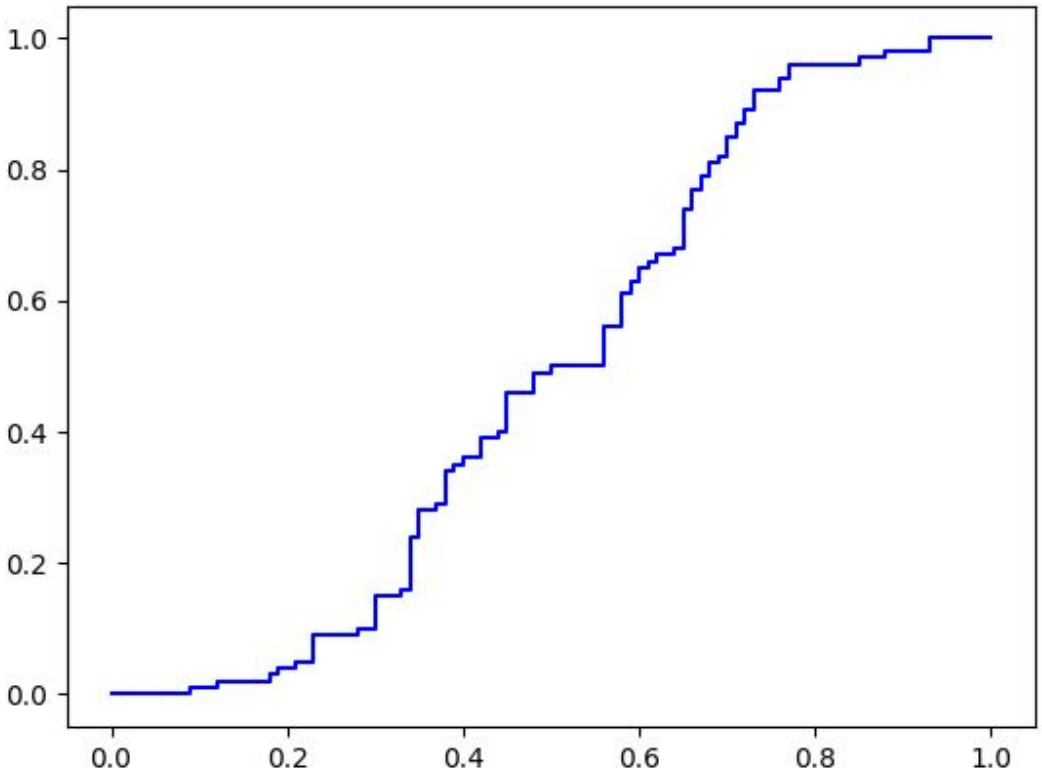
Visualizations for Non Face Data - Mean and Covariance:





ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

ROC Curve:



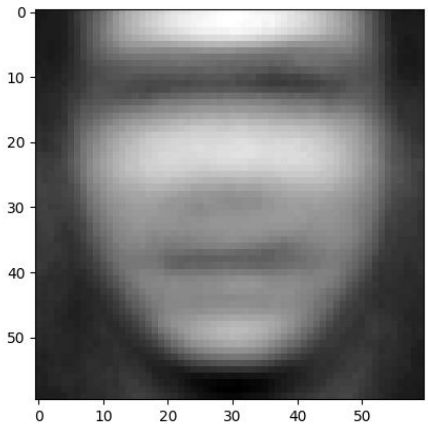
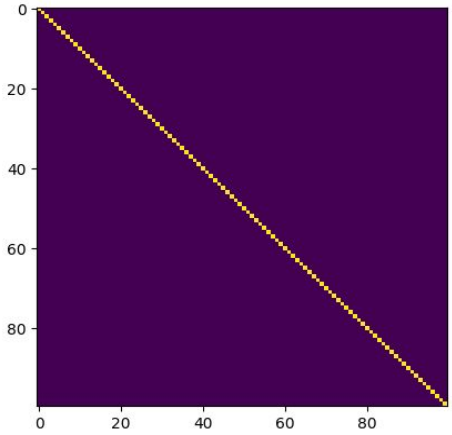
ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

Model 5 - Factor Analyzer:

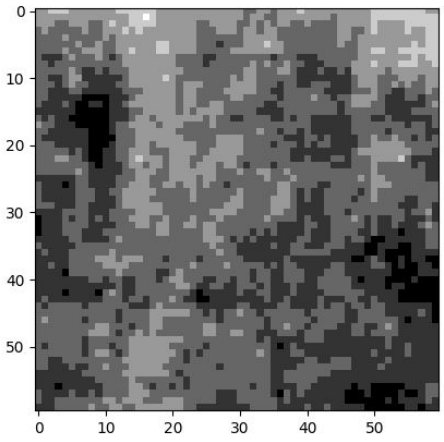
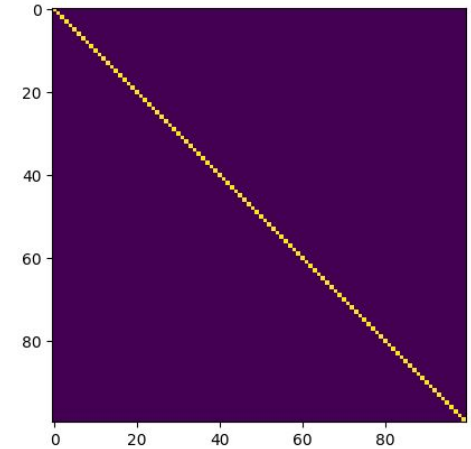
For Model 5 execution : python3 model_5.py

False Positive Rate: 0.27
False Negative Rate: 0.73
Misclassification Error: 0.525

Visualizations for Face Data - Mean and Covariance:

Visualizations for Non Face Data - Mean and Covariance:

ECE 763 - Project 1
Name: Parth Nagori
Unity ID: pnagori
Student ID: 200208747

ROC Curve: