

# ECE 763: Computer Vision

## Project – 1

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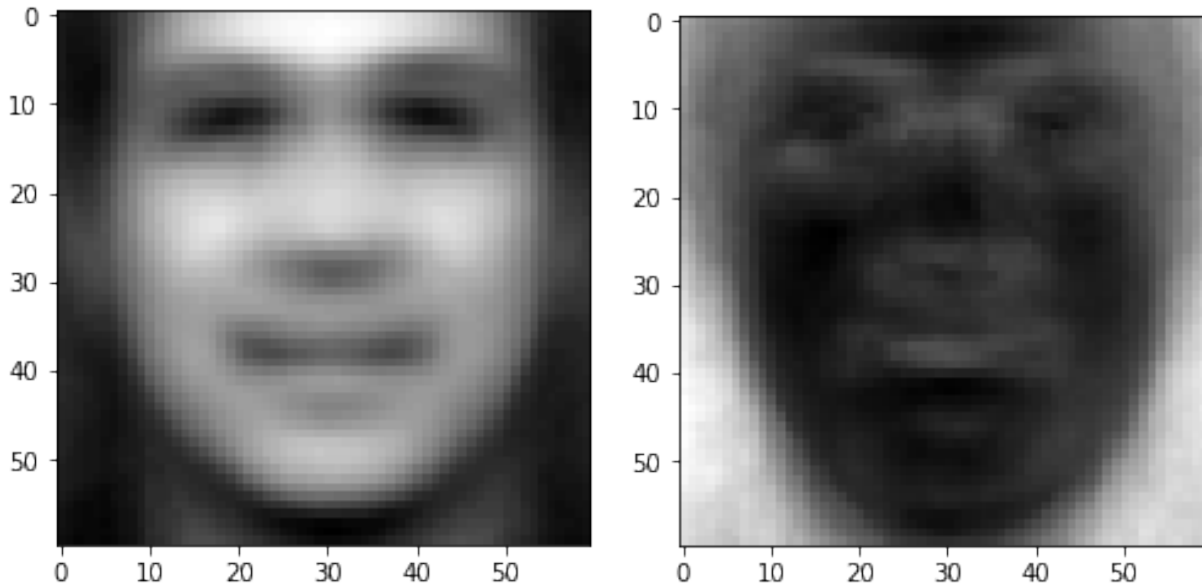
## DATASET:

For this project, I've used the UMD Faces Dataset (<http://www.umdfaces.io/>)

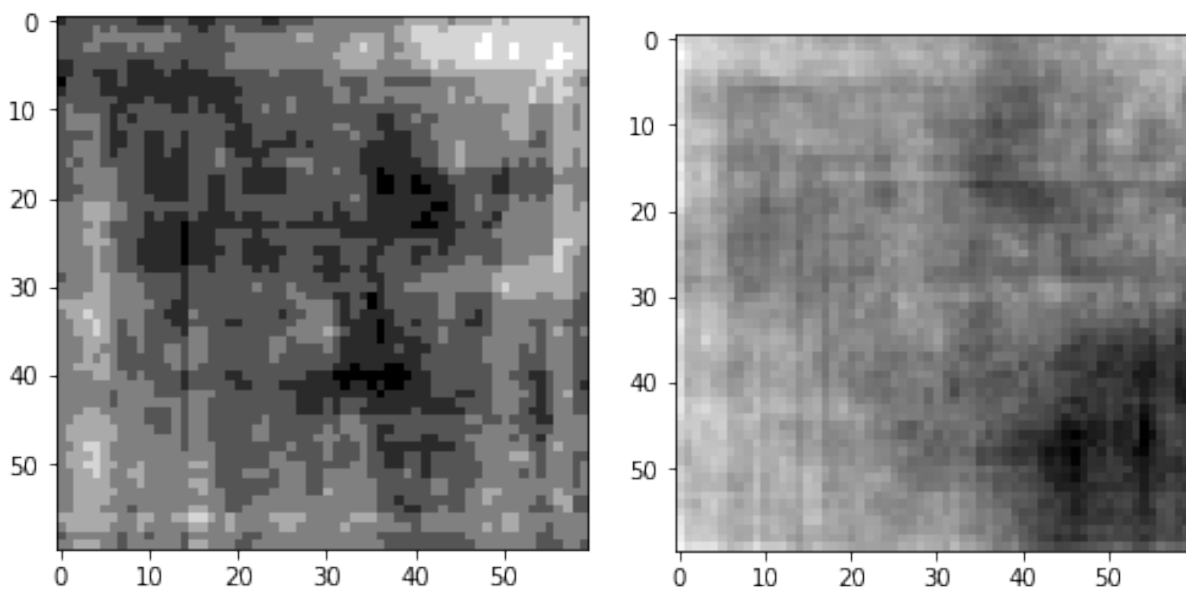
For preparation of dataset as per requirements, a module `data_io.DataPreparation` has been created which extracts given number of images from the umd faces dataset.

Similarly `data_io.DataLoader` is used to read in all the extracted images and load the dataset.

Following images show the mean and covariance of the face training images.



Following images show the mean and covariance of the non\_face training images.



From these set of images, we observe that non\_face images do not show any specific patterns in the mean/covariance images. For face class, we observe that mean image closely resembles a face and covariance image shows that most of the non-zero variance is on edges and in the background, which is expected.

### **MODELS:**

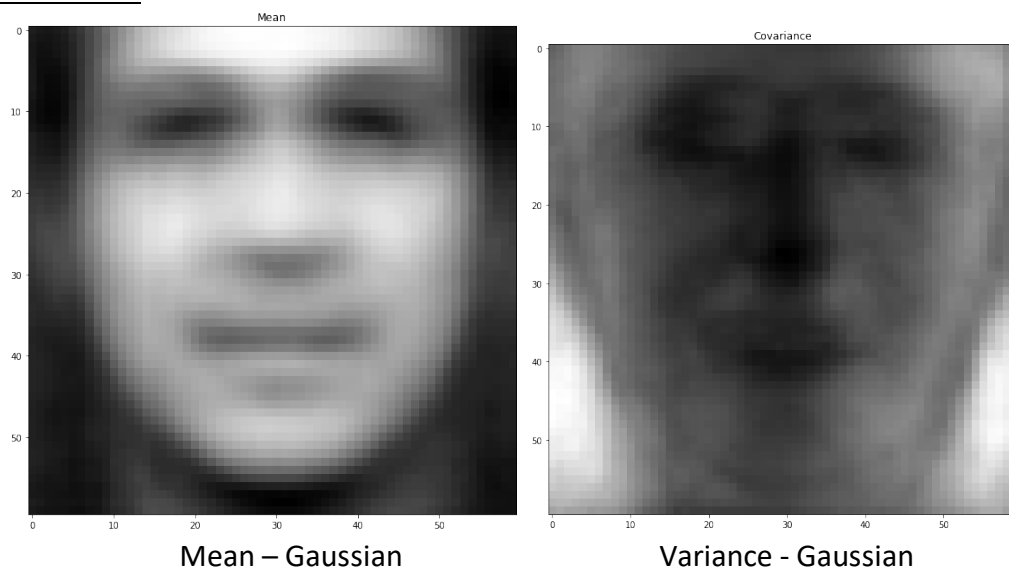
The models implemented are present in models/ directory. Model.py is the main file from which all models are run. A Python notebook named TestingModels.ipynb has also been created for the same purpose.

### **METHODOLOGY:**

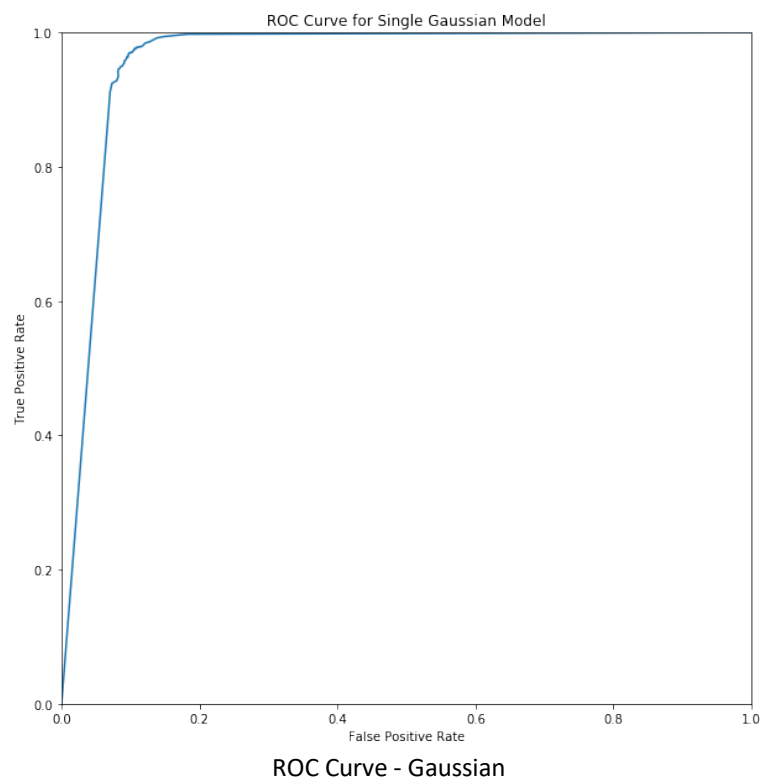
In this project, I use data preprocessing to generate training and test images from UMD Faces dataset.

I use Gray scale images for training all models. To reduce dimensionality, I use Principal Component Analysis.

## Model 1: Gaussian:

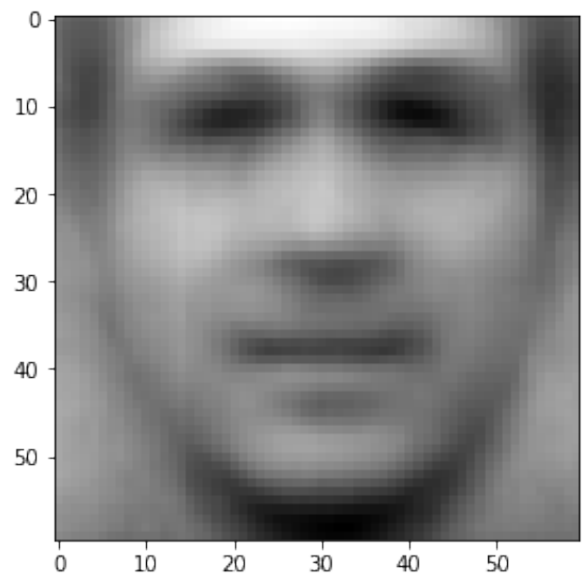
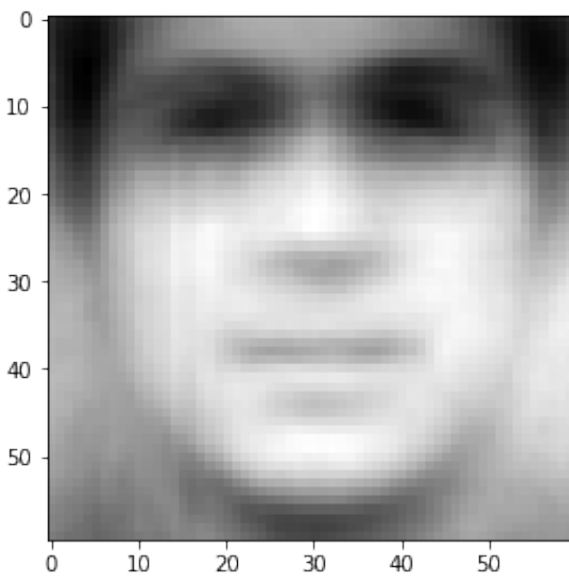
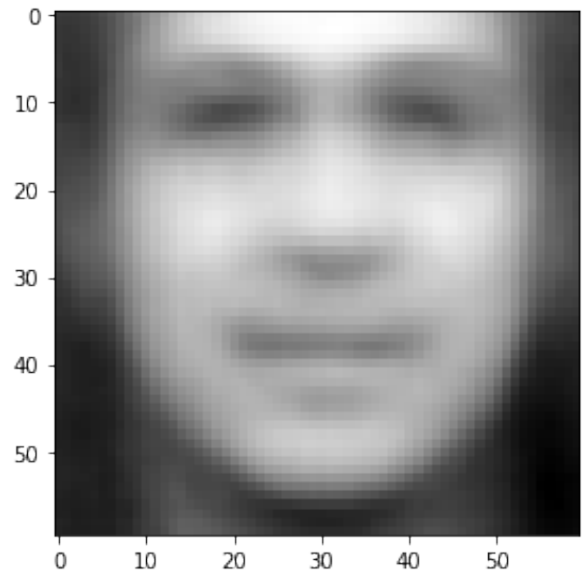
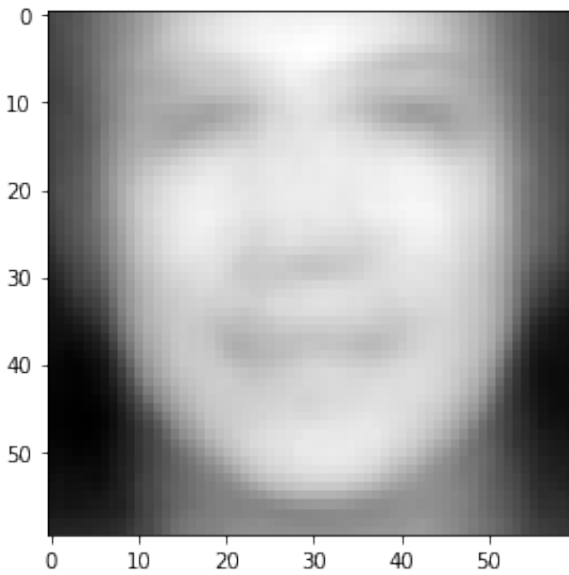


```
false_positive_rate = 0.0983302411874  
false_negative_rate = 0.0303687635575  
misclassification_rate = 0.067
```

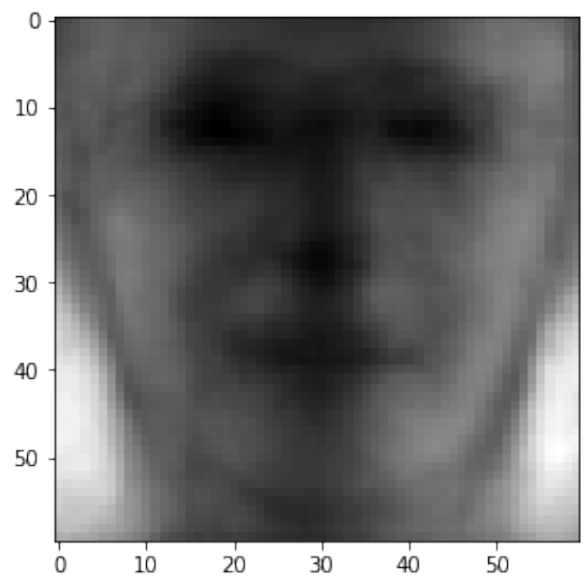
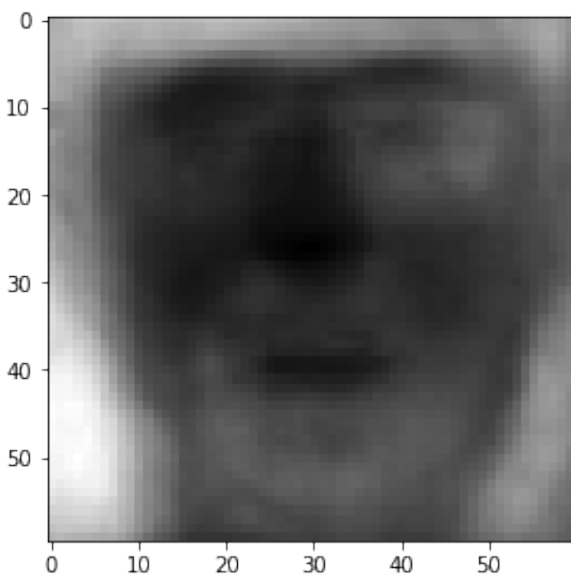
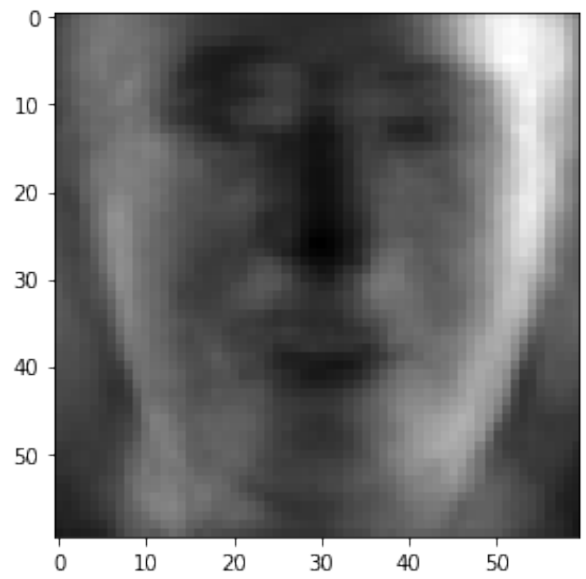
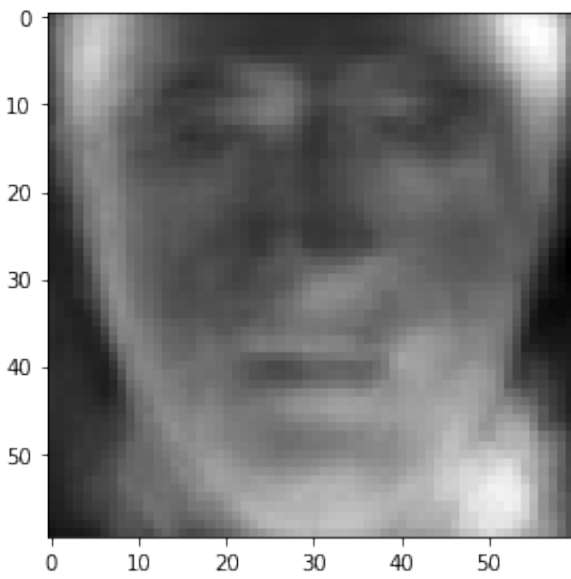


Model 2: Mixture of Gaussians:  
For number of components = 4

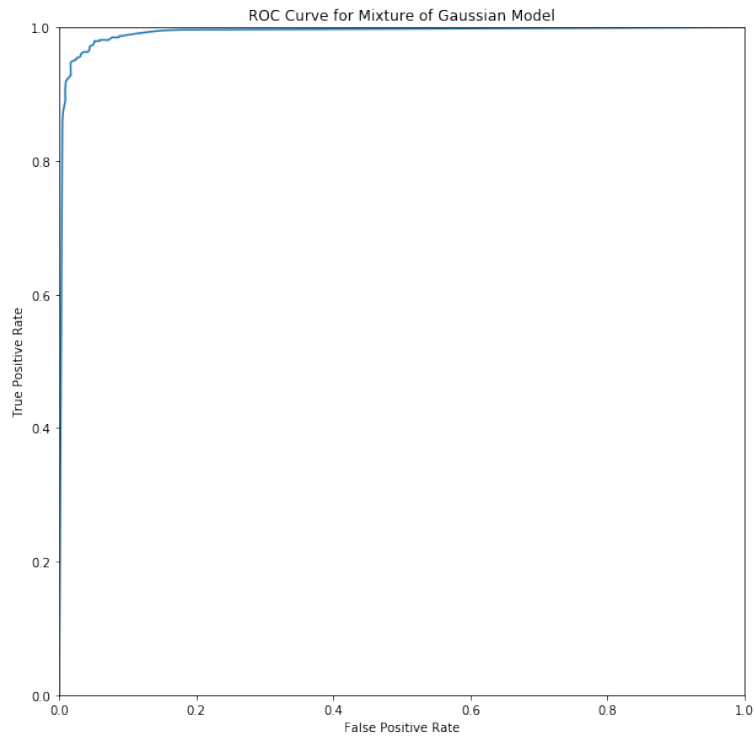
Means of Mixture of Gaussian



Diagonal Covariance for Mixture of Gaussian

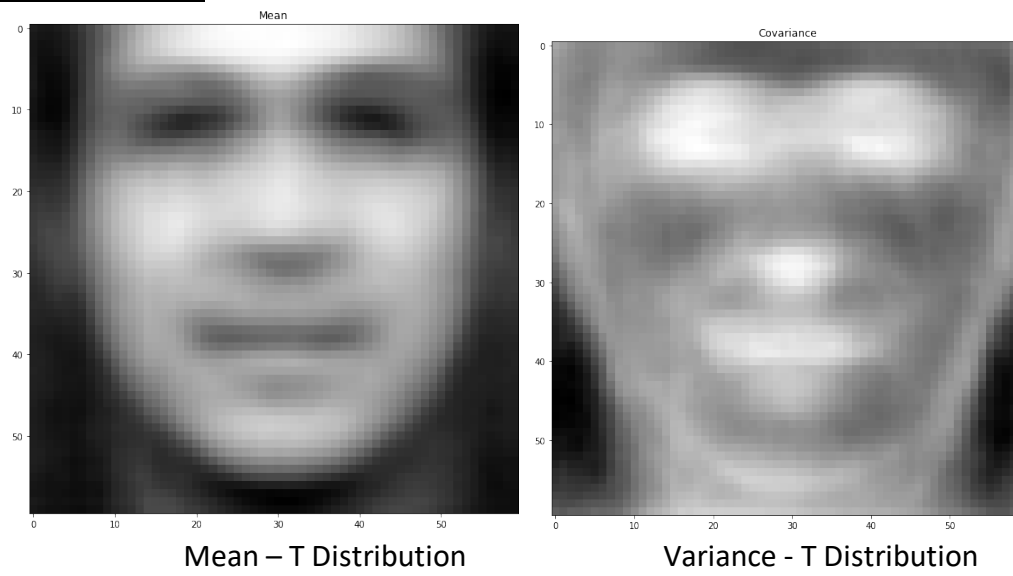


```
false_positive_rate = 0.0377358490566  
false_negative_rate = 0.031218529708  
misclassification_rate = 0.0345
```

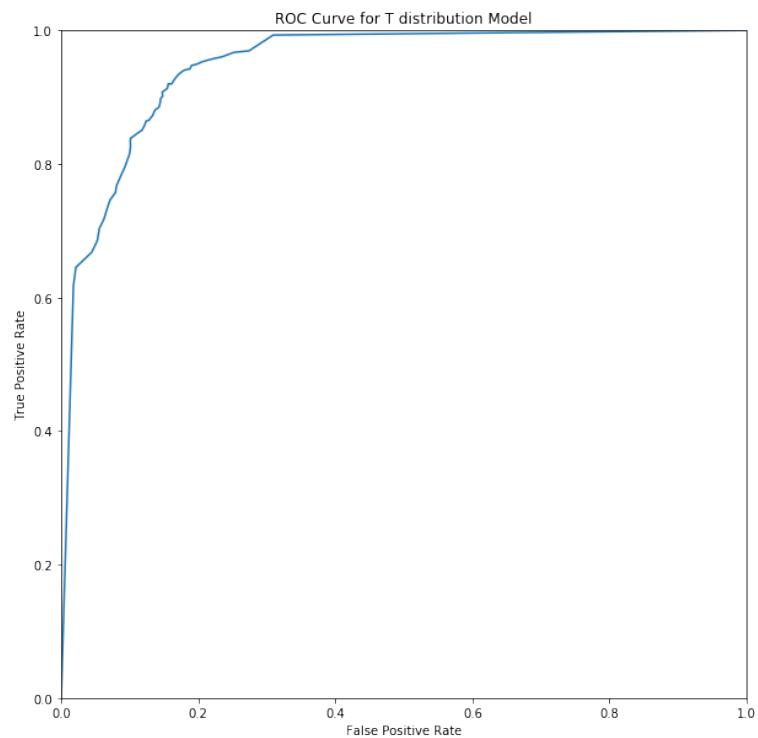


ROC Curve for Mixture of Gaussian

### Model 3: T Distribution:



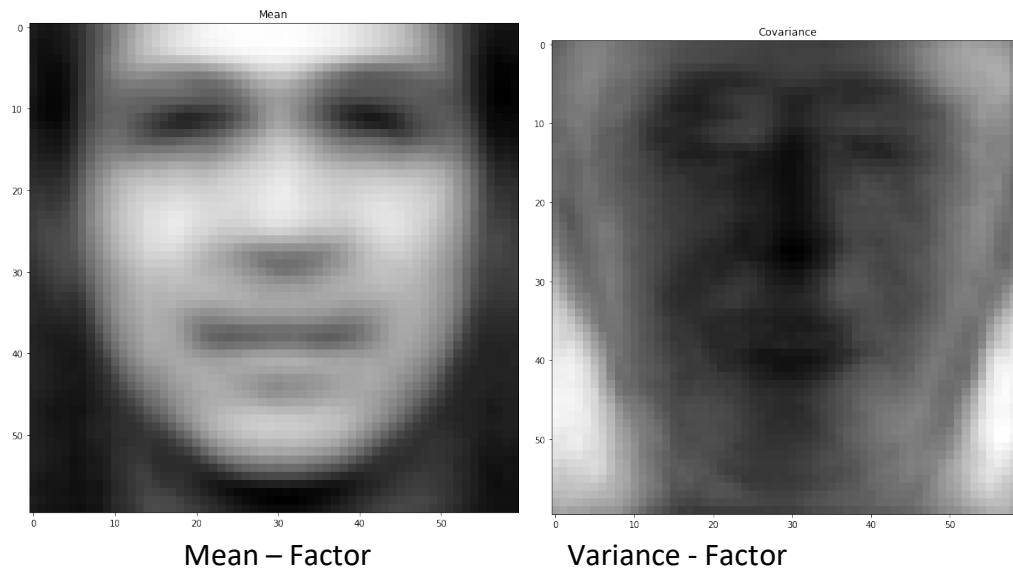
```
false_positive_rate = 0.131605184447  
false_negative_rate = 0.129388164493  
misclassification_rate = 0.1305
```



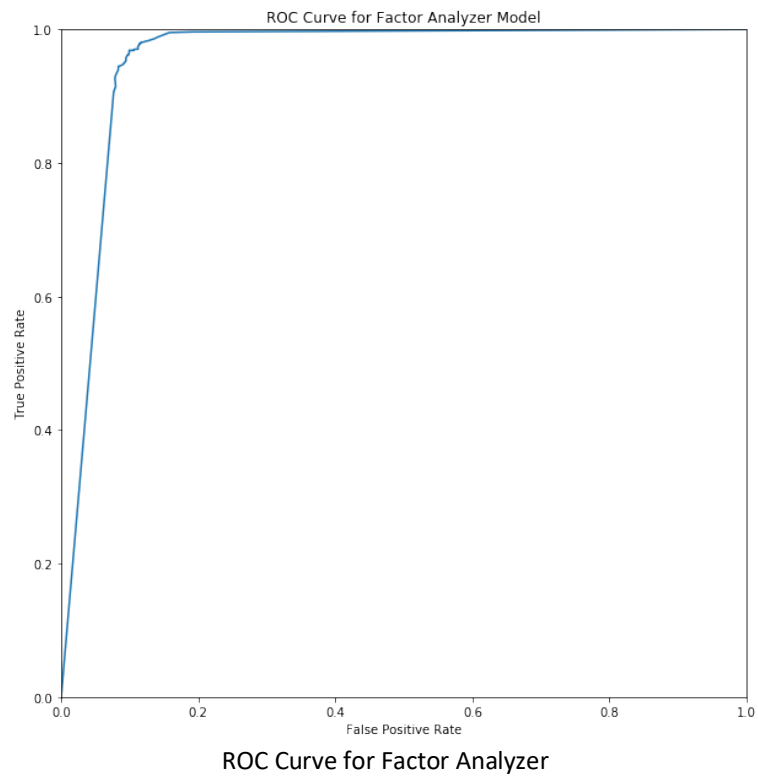


### Model 5: Factor Analyzer:

For Factor = 5



```
false_positive_rate = 0.098788443616  
false_negative_rate = 0.0355987055016  
misclassification_rate = 0.0695
```



**REFERENCES:**

1. Ankan Bansal, Anirudh Nanduri, Carlos D Castillo, Rajeev Ranjan, and Rama Chellappa, UMDFaces: An Annotated Face Dataset for Training Deep Networks, Arxiv preprint, 2016.
2. Simon J.D. Prince, Computer Vision: models, learning and inference, 2012
3. Simon J.D. Prince, Algorithms Booklet for Computer Vision: models, learning and inference, 2013