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ECE 763 – COMPUTER VISION PROJECT 1 REPORT

TASK: Implementation of Face Image Classification using Gaussian, Mixture of Gaussian, t-distribution and Factor Analysis.

IMAGE DATA USED:

- I have used the FDDB(Face Detection and Data Set Benchmark) dataset for this project.
- n=1000 training images for face and non-face extracted.
- m=100 testing images for face and non-face extracted.
- I have set the resolution of the images extracted as 10x10 by defining the variable 'res' as 10, which means that the dimension of the training and testing images were taken as 10x10. This can be changed to 20x20 and 60 x60 as well.
- Annotations were used to crop out face images ,while non-face images were randomly cropped from the background.

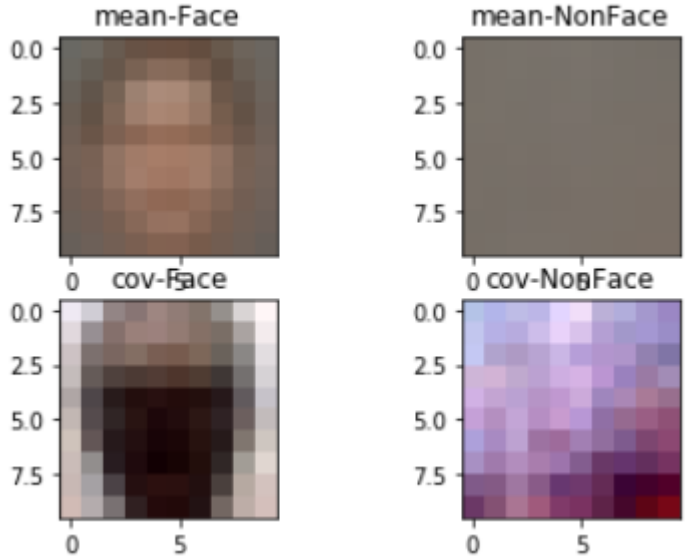
LAYOUT OF THE SOLUTION:

1. Mean and Covariance image matrices are visualized for all the models in the RGB colorspace.
2. False positive rate, False negative rate and misclassification rates have been tabulated for each model, taking 0.5 as the threshold for posterior.
3. Finally, the ROC curves for each model is plotted by varying the thresholds for the posterior- by taking the Sensitivity (True Positive Rate) on the y-axis and the (1-Specificity) False positive Rate on the x-axis.

ANALYSIS:

a) Gaussian Model:

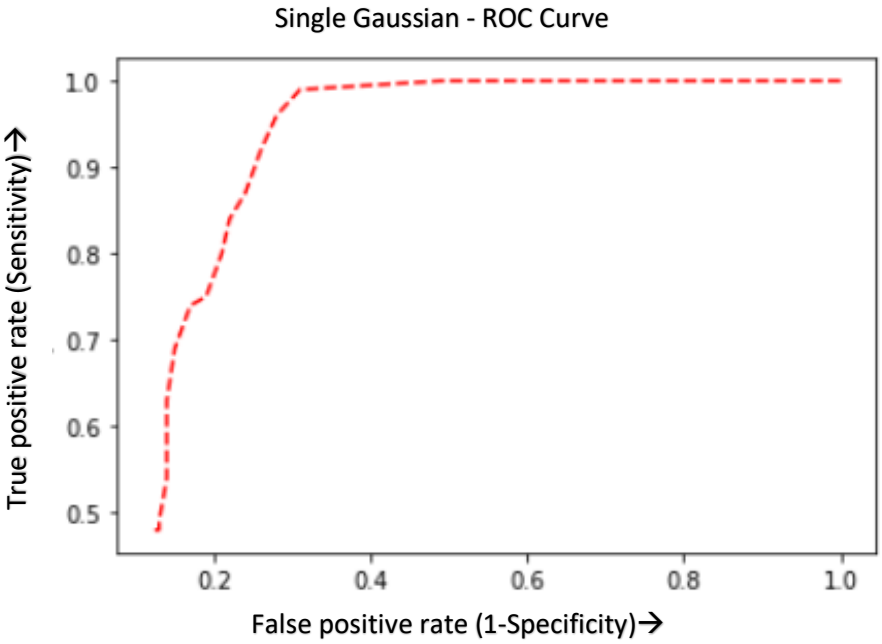
i) Mean and covariance image matrices:



ii) FALSE POSITIVE RATE, FALSE NEGATIVE RATE AND MISCLASSIFICATION RATE:

- **False positive rate: 0.31**
- **False negative rate: 0.01**
- **Misclassification rate: 0.16**

iii) ROC CURVE FOR SINGLE GAUSSIAN **:**



b) Mixture of Gaussian Model:

Based on the false positive rate, false negative rate and misclassification rate when using 1 cluster to 6 clusters on train images, it was found that using 6 clusters has the smallest false rate. Therefore, a mixture of gaussian with 6 clusters has been chosen to perform on the test images.

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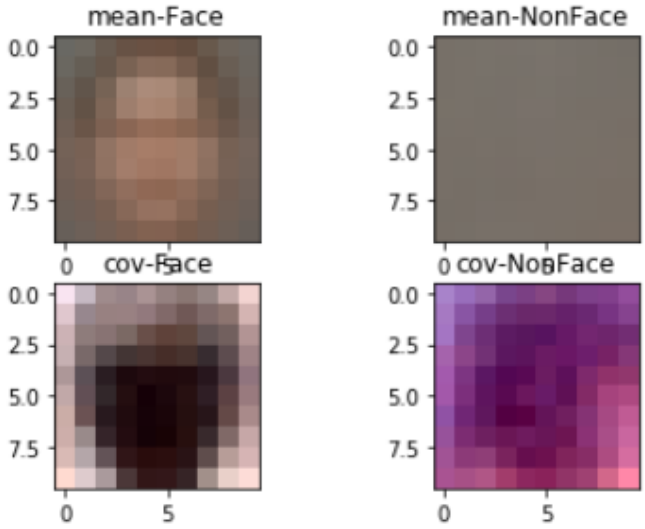
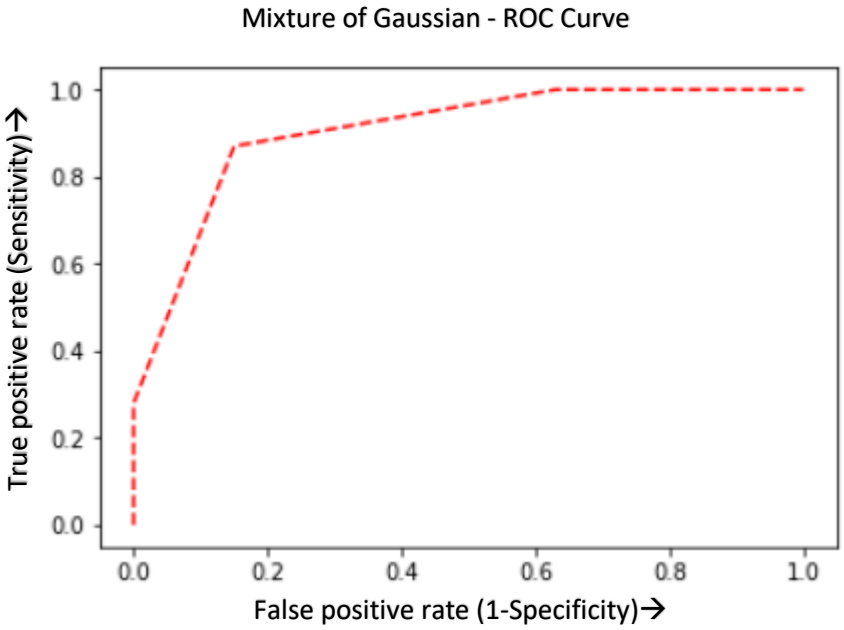
i) Mean and covariance image matrices:



ii) FALSE POSITIVE RATE, FALSE NEGATIVE RATE AND MISCLASSIFICATION RATE:

- **False positive rate: 0.19**
- **False negative rate: 0.12**
- **Misclassification rate: 0.155**

iii) ROC CURVE FOR MIXTURE OF GAUSSIAN **:**



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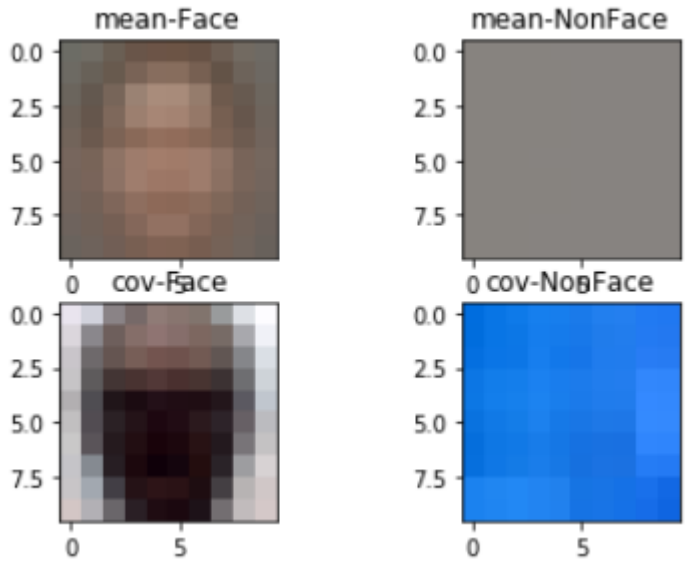
c) t-DISTRIBUTION Model:

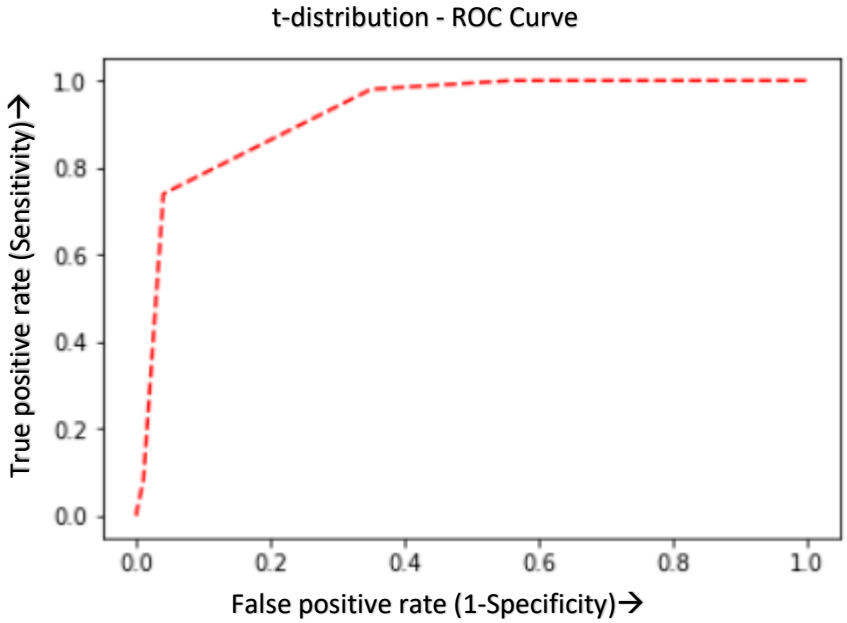
i) Mean and covariance image matrices:



ii) FALSE POSITIVE RATE, FALSE NEGATIVE RATE AND MISCLASSIFICATION RATE:

- **False positive rate: 0.35**
- **False negative rate: 0.02**
- **Misclassification rate: 0.185**

iii) ROC CURVE FOR t-Distribution**:**



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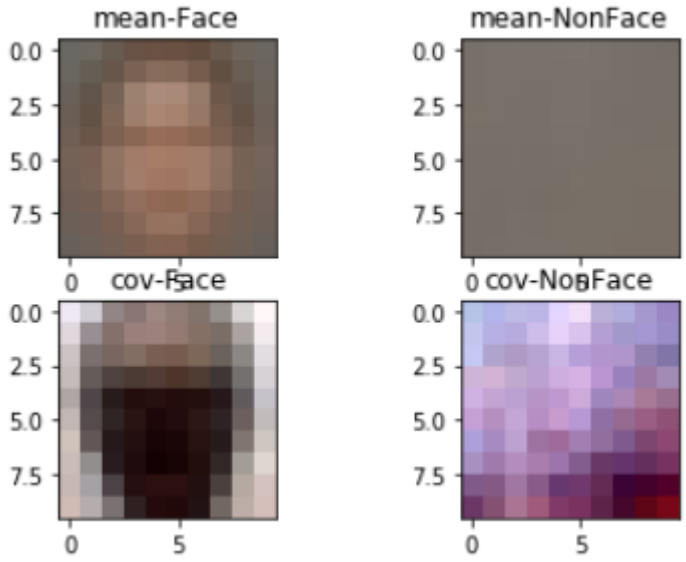
d) Factor Analysis:

iv) Mean and covariance image matrices:



v) FALSE POSITIVE RATE, FALSE NEGATIVE RATE AND MISCLASSIFICATION RATE:

- **False positive rate: 0.37**
- **False negative rate: 0.16**
- **Misclassification rate: 0.265**

vi) ROC CURVE FOR Factor Analysis **:**