ECE 763 Computer Vision

Project-1 Report

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Face image classification using

Gaussian model, Mixture of Gaussian model, T Distribution, Mixture of T Distribution and Factor Analysis

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Dataset: http://www.ifp.illinois.edu/~vuongle2/helen/

The dataset contains 2000 images with its respective bounding box face annotation.

Training Dataset:

Face: 1000 images from the dataset are used for training the models. After cropping out the bounding box the images are resized to 60 x 60 x 3 pixel size such that only faces are kept.

Non-face: 1000 images for training are formed by cropping out 60 x 60 x 3 regions from the background of the original training face images.

Test Dataset:

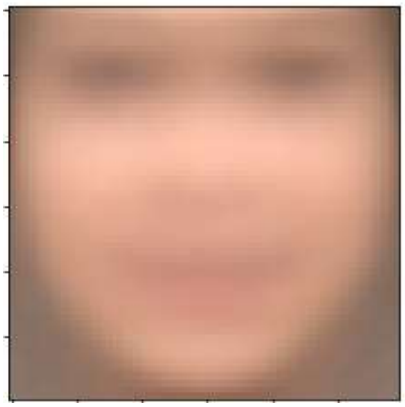
Face: 100 images from the dataset are used for training the models. After cropping out the bounding box the images are resized to 60 x 60 x 3 pixel size such that only faces are kept.

Non-face: 100 images for training are formed by cropping out 60 x 60 x 3 regions from the background of the original testing face images.

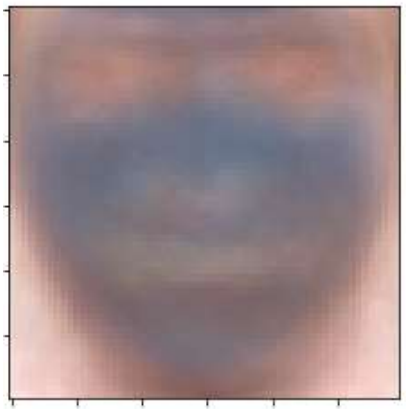
Model 1: Gaussian Model

Visualize the estimated mean and covariance matrix for face and non-face

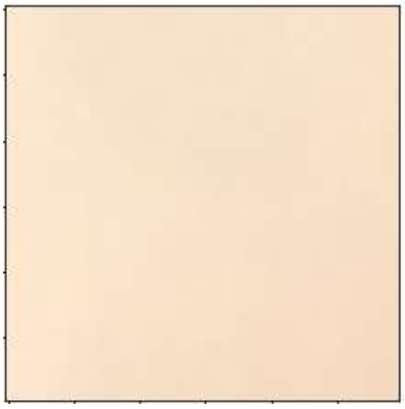
Mean of Face Images



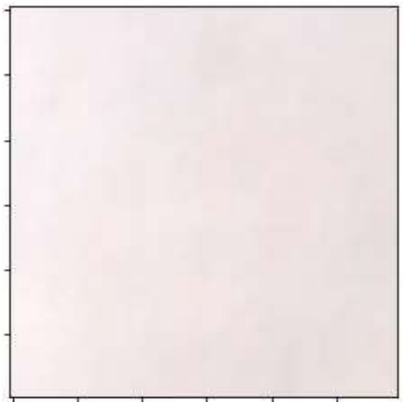
Covariance of Face Images



Mean of Non Face Images



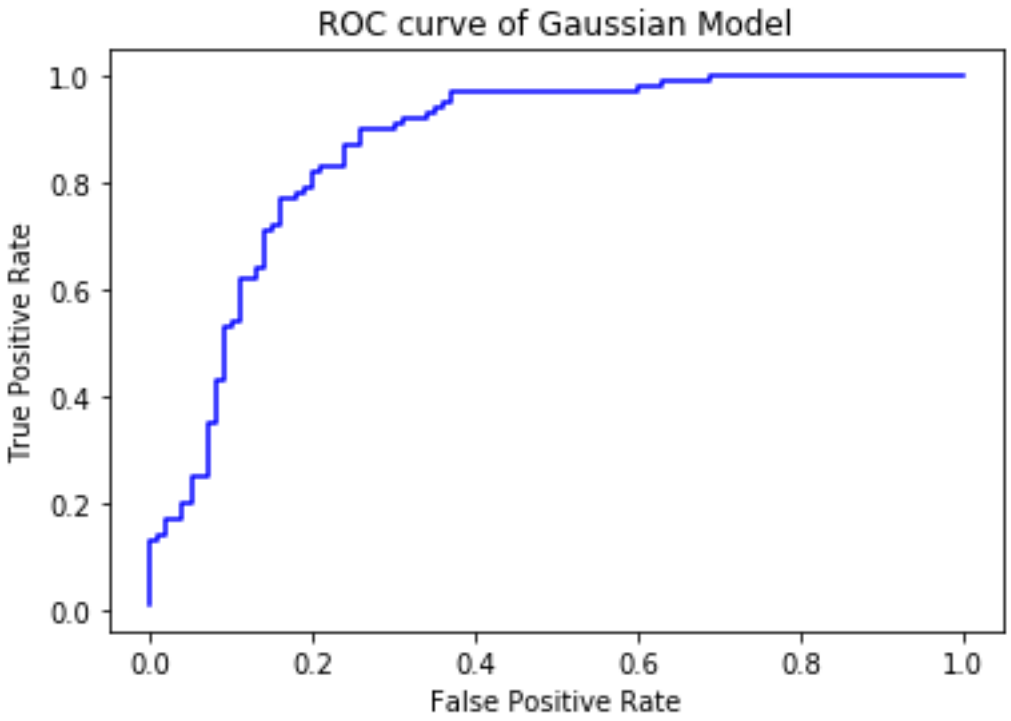
Covariance of Non Face Images



Evaluating the learned model on the testing images using 0.5 as threshold for the posterior following observations were found.

1. False Positive Rate: 0.26
2. False Negative Rate: 0.11
3. Misclassification Rate: 0.185

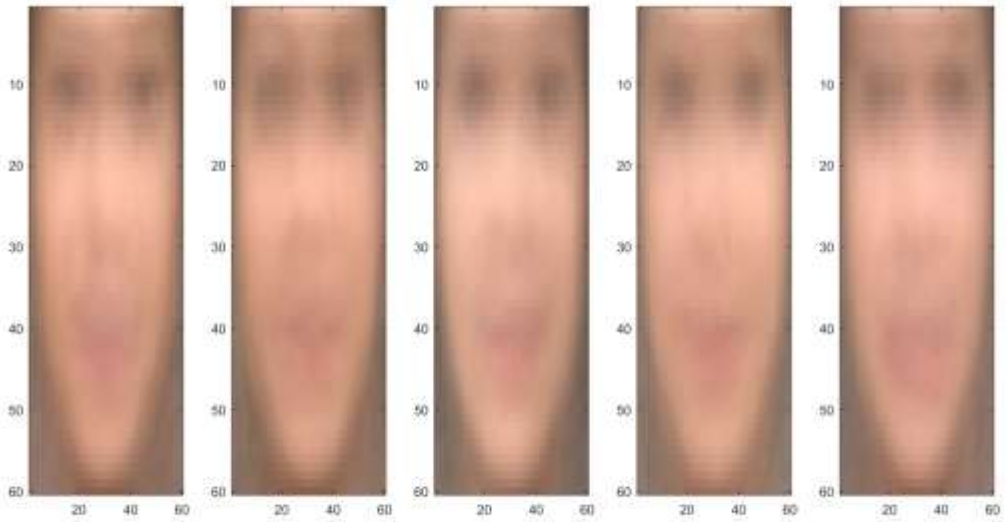
ROC CURVE


ROC curve of Gaussian Model
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0

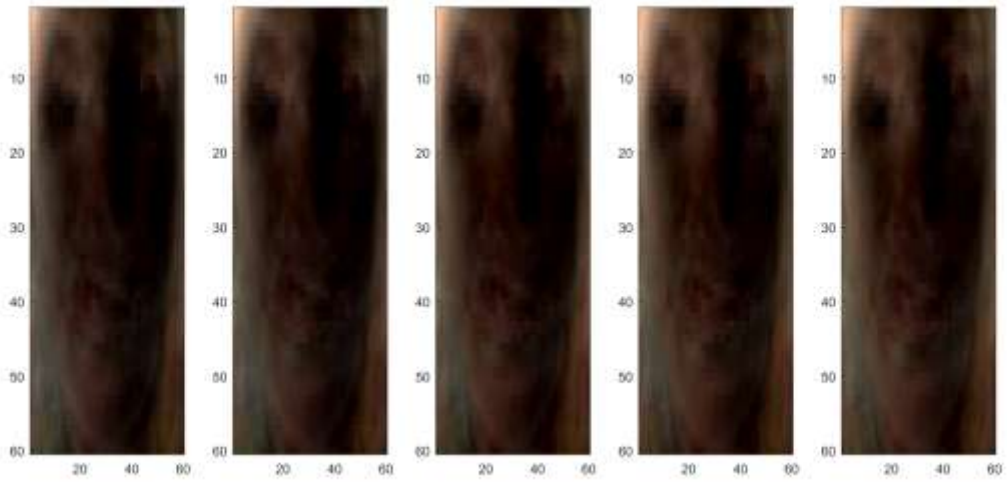
Model 2: Mixture of Gaussian Model with 5 Gaussian Distributions

Visualize the estimated mean and covariance matrix for face and non-face

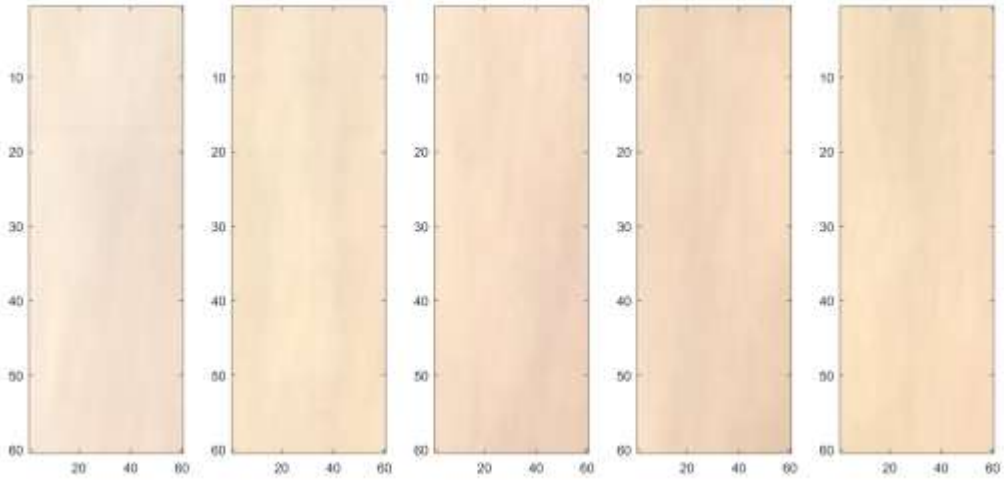
Mean of Face Images



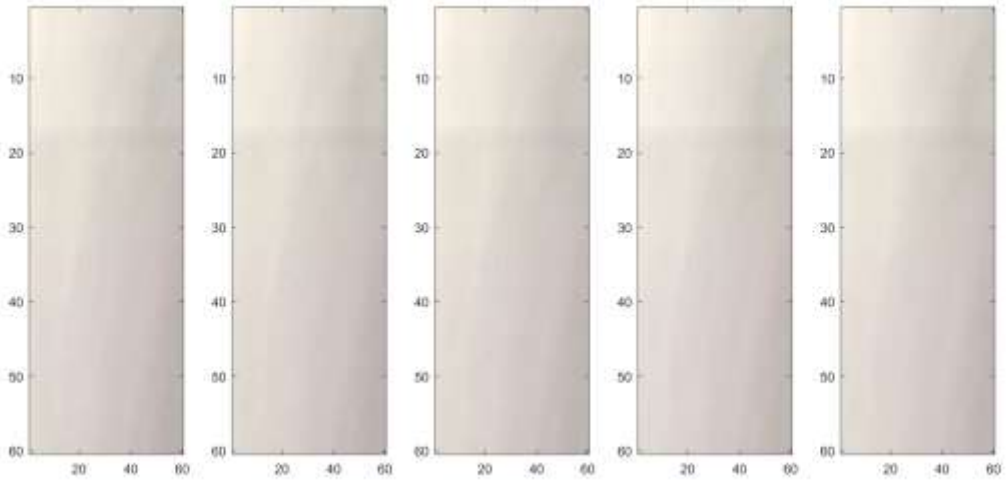
Covariance of Face Images



Mean of Non Face Images



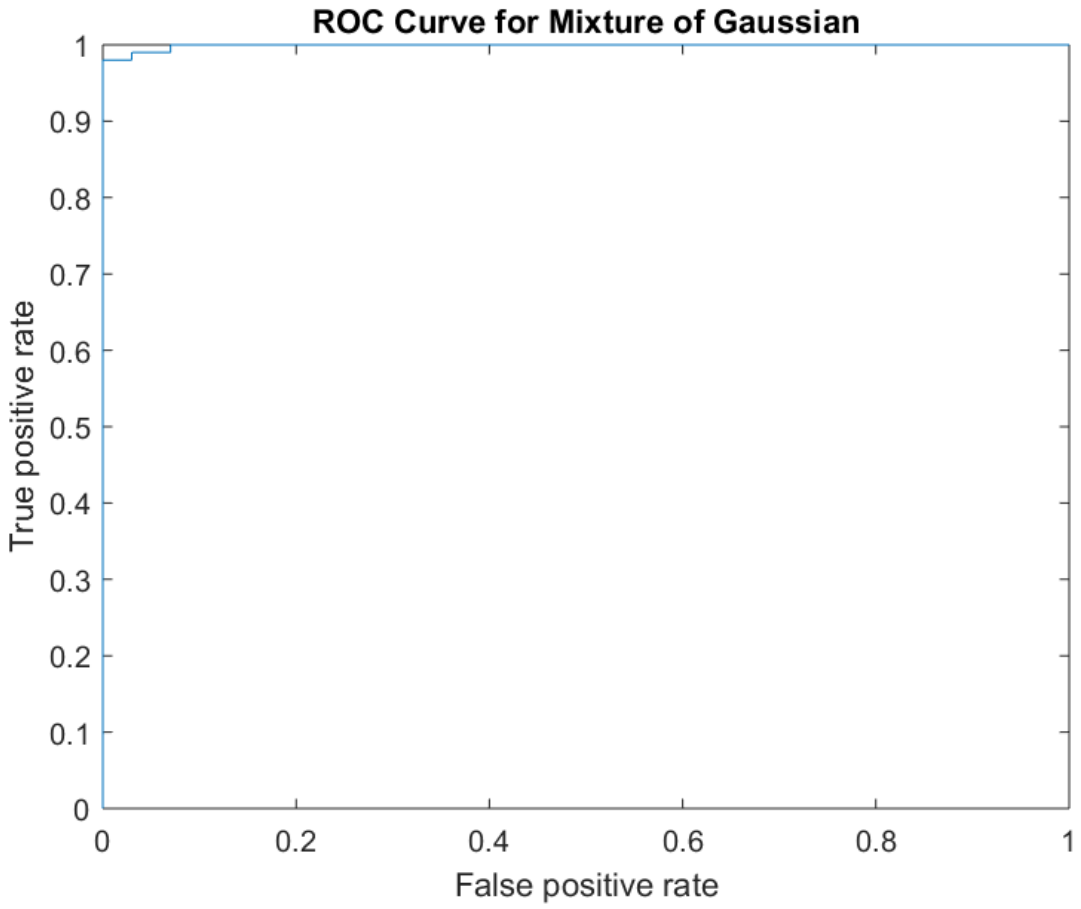
Covariance of Non Face Images



Evaluating the learned model on the testing images using 0.5 as threshold for the posterior following observations were found.

1. False Positive Rate: 0.03
2. False Negative Rate: 0.02
3. Misclassification Rate: 0.025

ROC CURVE


ROC Curve for Mixture of Gaussian
True positive rate
False positive rate
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.2
0.4
0.6
0.8
1

Model 3: T Distribution Model

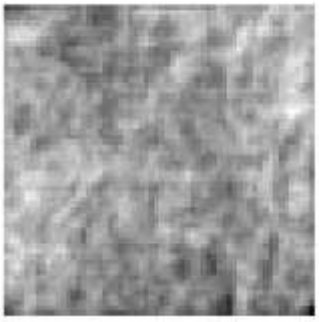
For this Model PCA has been applied to Gray Images of 60 x 60 pixel size. The model was trained using 68 PC faces each of 3600 pixels.

Visualize the estimated mean and covariance matrix for face and non-face

Mean of Face Images

Covariance of Face Images

Mean of Non Face Images

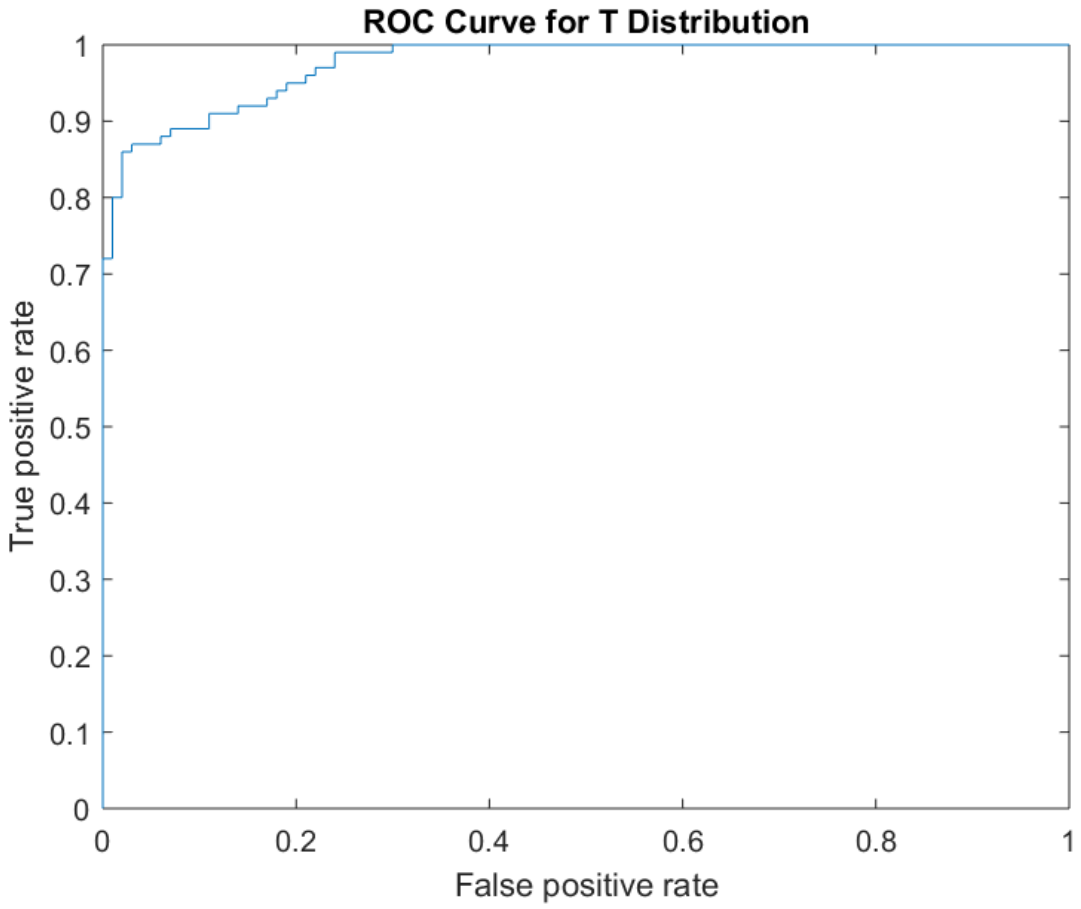


Covariance of Non Face Images

Evaluating the learned model on the testing images using 0.5 as threshold for the posterior following observations were found.

1. False Positive Rate: 0.05
2. False Negative Rate: 0.13
3. Misclassification Rate: 0.09

ROC CURVE


ROC Curve for T Distribution
True positive rate
False positive rate
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.2
0.4
0.6
0.8
1

Model 4: Mixture of T Distribution with 5 T Distributions

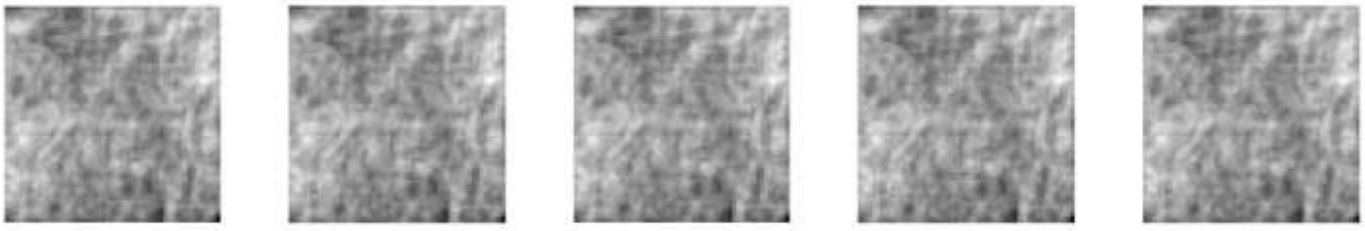
For this Model PCA has been applied to Gray Images of 60 x 60 pixel size. The model was trained using 68 PC faces each of 3600 pixels.

Visualize the estimated mean and covariance matrix for face and non-face

Mean of Face Images

Covariance of Face Images

Mean of Non Face Images

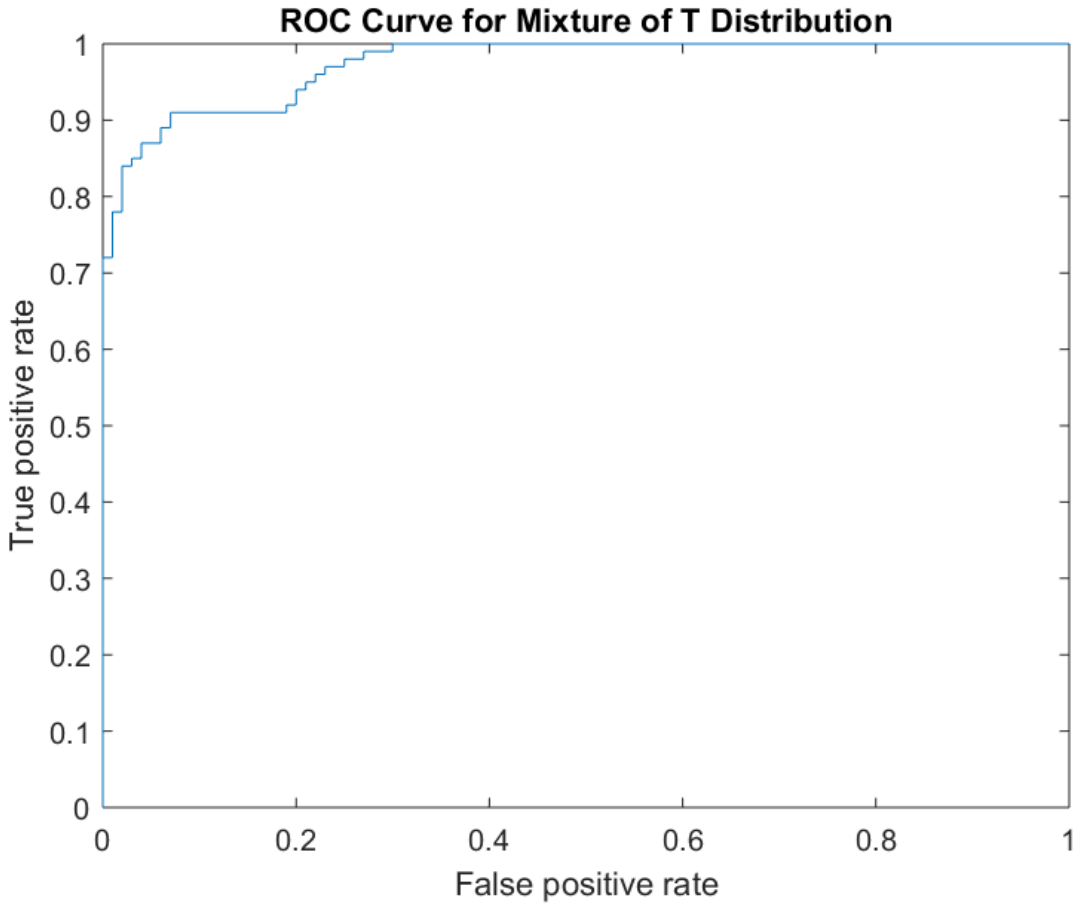


Covariance of Non Face Images

Evaluating the learned model on the testing images using 0.5 as threshold for the posterior following observations were found.

1. False Positive Rate: 0.01
2. False Negative Rate: 0.26
3. Misclassification Rate: 0.135

ROC CURVE



Model 5: Factor Analysis with 10 factors

Visualize the estimated mean and covariance matrix for face and non-face

Mean of Face Images

Covariance of Face Images

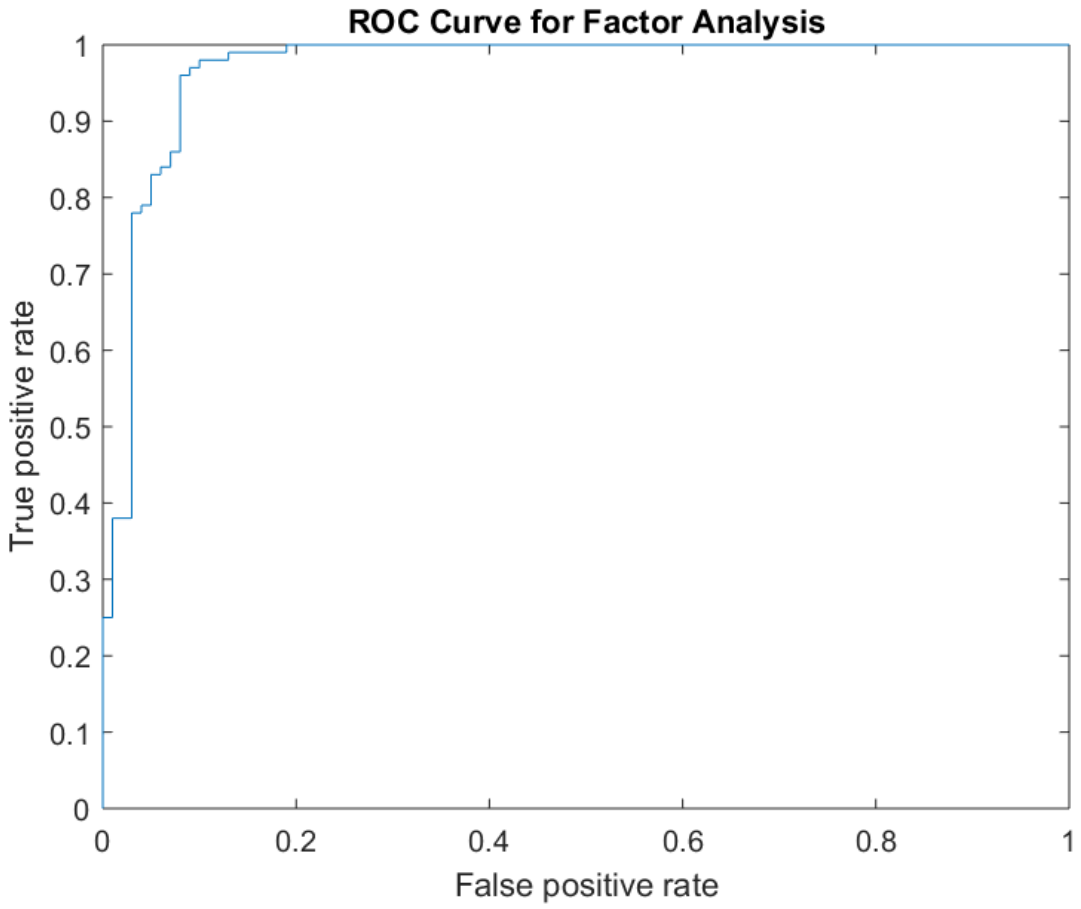
Mean of Non Face Images

Covariance of Non Face Images

Evaluating the learned model on the testing images using 0.5 as threshold for the posterior following observations were found.

1. False Positive Rate: 0.14
2. False Negative Rate: 0.01
3. Misclassification Rate: 0.075

ROC CURVE


ROC Curve for Factor Analysis
True positive rate
False positive rate
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.2
0.4
0.6
0.8
1