Project Report 2
Supervised Learning
Face Recognition System using LDA
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❖ **Aim:** Here we have to do Face Recognition using Linear Discriminant Analysis (LDA) and have to perform Comparison with Principal Component Analysis (PCA) based Face Recognition.

❖ **Database Used:** Here we have used the AT&T database which is freely downloadable and contains a set of 400 face images (http://www.cl.cam.ac.uk/research/dtg/attarchive/facedatabase.html). There are ten different images of each of 40 distinct subjects .For some subjects, the images were taken at different times, varying the lighting, facial expressions (open / closed eyes, smiling / not smiling) and facial details (glasses / no glasses).

❖ **Implementation Steps for LDA:**

- Prepare a training set of face images
- Each image is treated as one vector, simply by concatenating the rows of pixels in the original images
- Compute Within and Between class Scatter Matrices.
- Calculate the eigen vectors and eigenvalues of the covariance matrix.
- Choose the principal components. Sort the eigenvalues in descending order and arrange eigen vectors accordingly.

❖ **Protocol:** Face verification based on LDA will be evaluated using the protocol discussed in the class
Training set: 1-5 images of 40 subjects (for enrollment and fisher space generation)
Testing set: 6-10 images of 40 subjects

❖ **Well defined MATLAB Code:**
Submitted in the zip file with the report

❖ **Comparison of PCA with LDA**

There are many possible techniques for classification of data. Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) are two commonly used techniques for data classification and dimensionality reduction.

Linear Discriminant Analysis easily handles the case where the within-class frequencies are unequal and their performances has been examined on randomly generated test data. This method maximizes the ratio of between-class variance to the within-class variance in any particular data set thereby guaranteeing maximal separability.

The use of Linear Discriminant Analysis for data classification is applied to classification problem in speech recognition. The prime difference between LDA and PCA is that PCA does more of feature classification and LDA does data classification.

In PCA, the shape and location of the original data sets changes when transformed to a different space whereas LDA doesn't change the location but only tries to provide more class separability and draw a decision region between the given classes. This method also helps to better understand the distribution of the feature data

❖ Accuracy of PCA ion AT and T database is 83.01 % and accuracy of LDA on the same data is 79.96%. The accuracy depends on the database and various other factors.
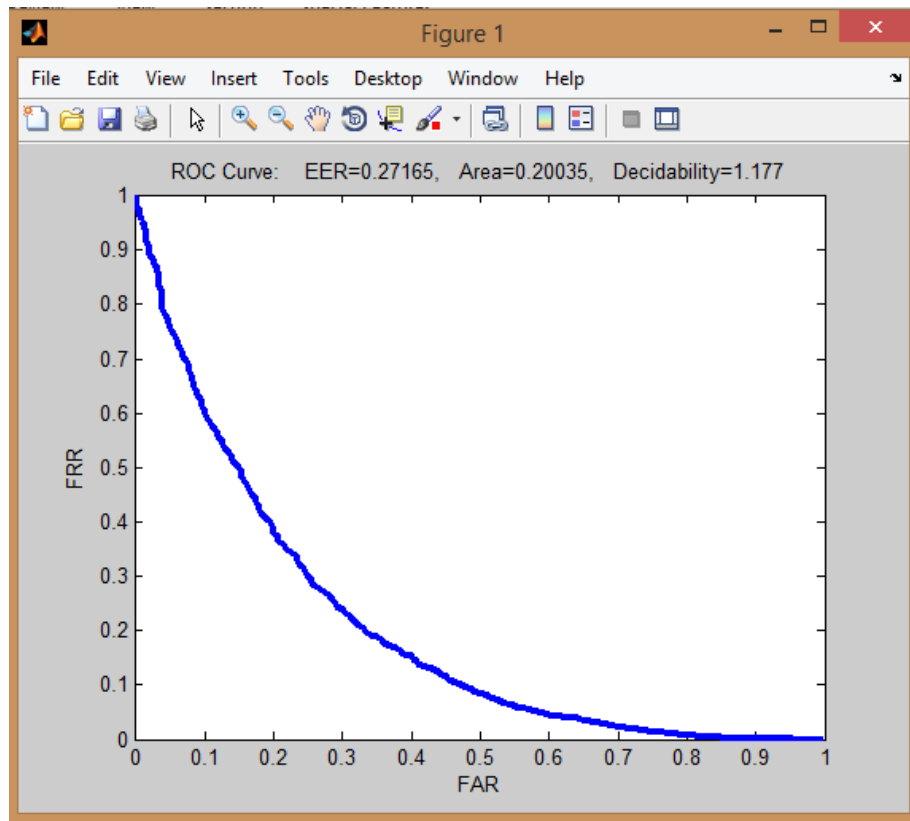
❖ Performance of LDA:

The performance goes on decreasing as we decrease the number of principle components.

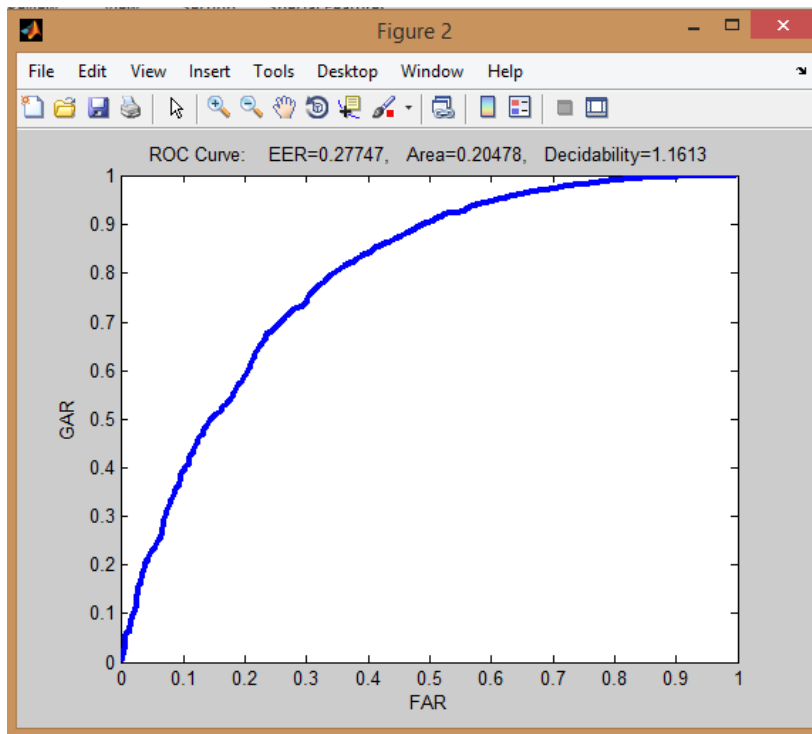**When the principle components were 40 the graphs are given below:**
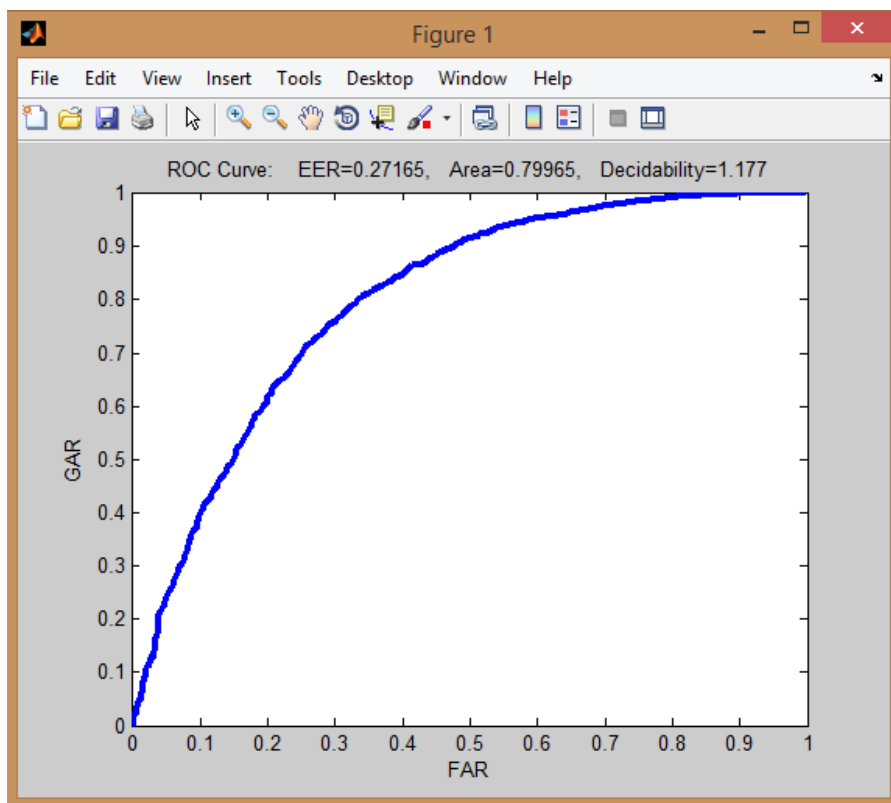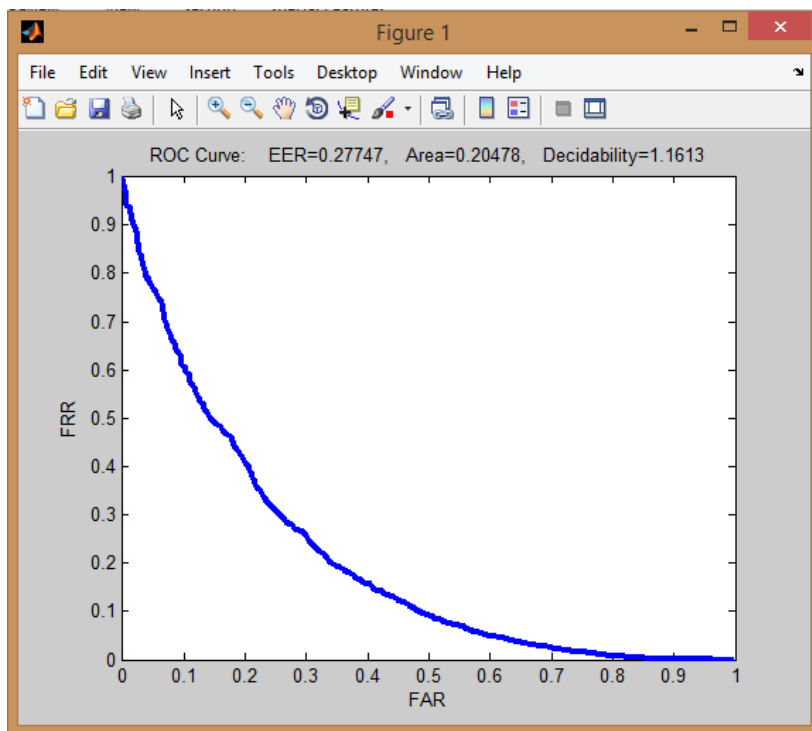
GAR vs FAR

FAR vs FRR

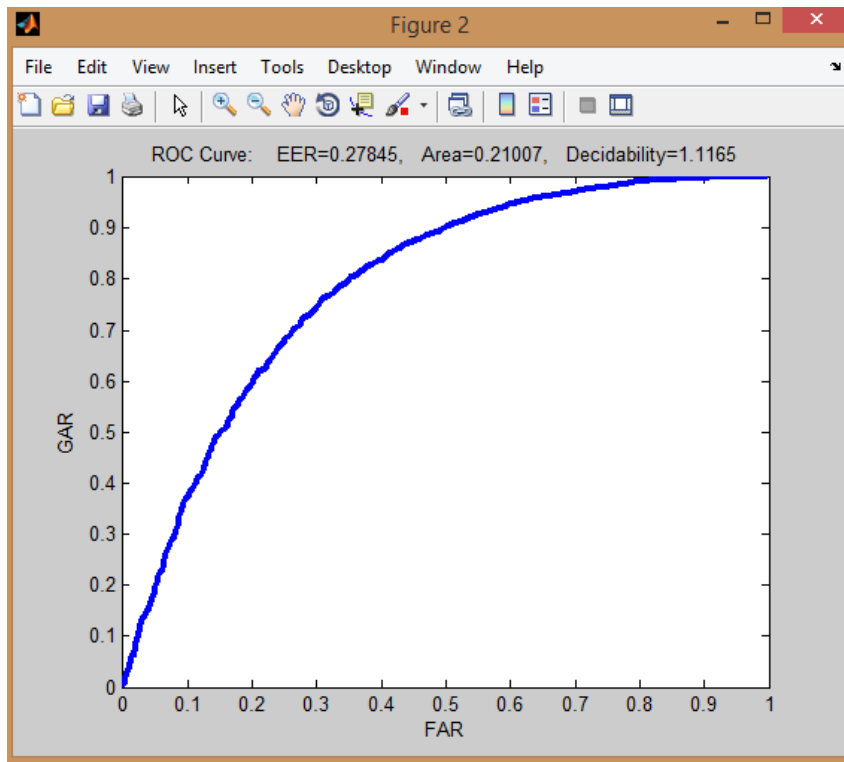When the principle components were 35 the graphs are given below:
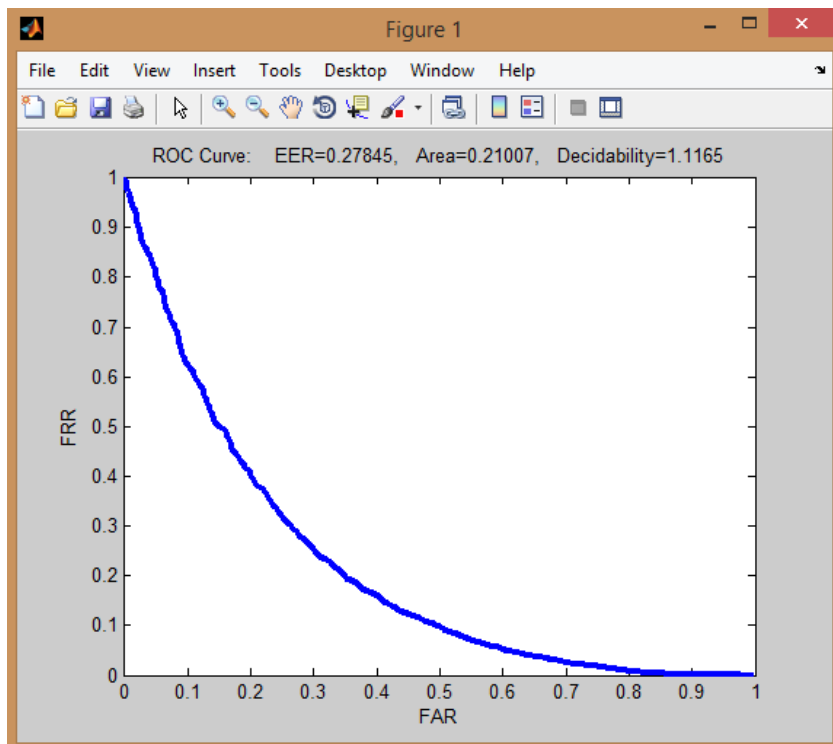
GAR vs FAR

FRR vs FAR

When the principle components are 30 the graphs are given below:

GAR vs FAR

FRR vs FAR

Conclusion-

The above graph clearly depicts the difference between the performance of LDA vs PCA over the given set of data. Their reported accuracy varies in terms of different parameters such as different data set or hardware used.