Stat251 (CS276A)

Project I : Principal Component analysis for Human Faces

Mahati Kumar

UCLA ID: 004414435

Part 1: ASM and AAM Model for face Reconstruction

Given : Training image Set contains 150 faces from which the Eigenvalues and the Eigenvectors are to be calculated. There are also 27 Test images given.

For the Question(1) of Part 1,

Description:

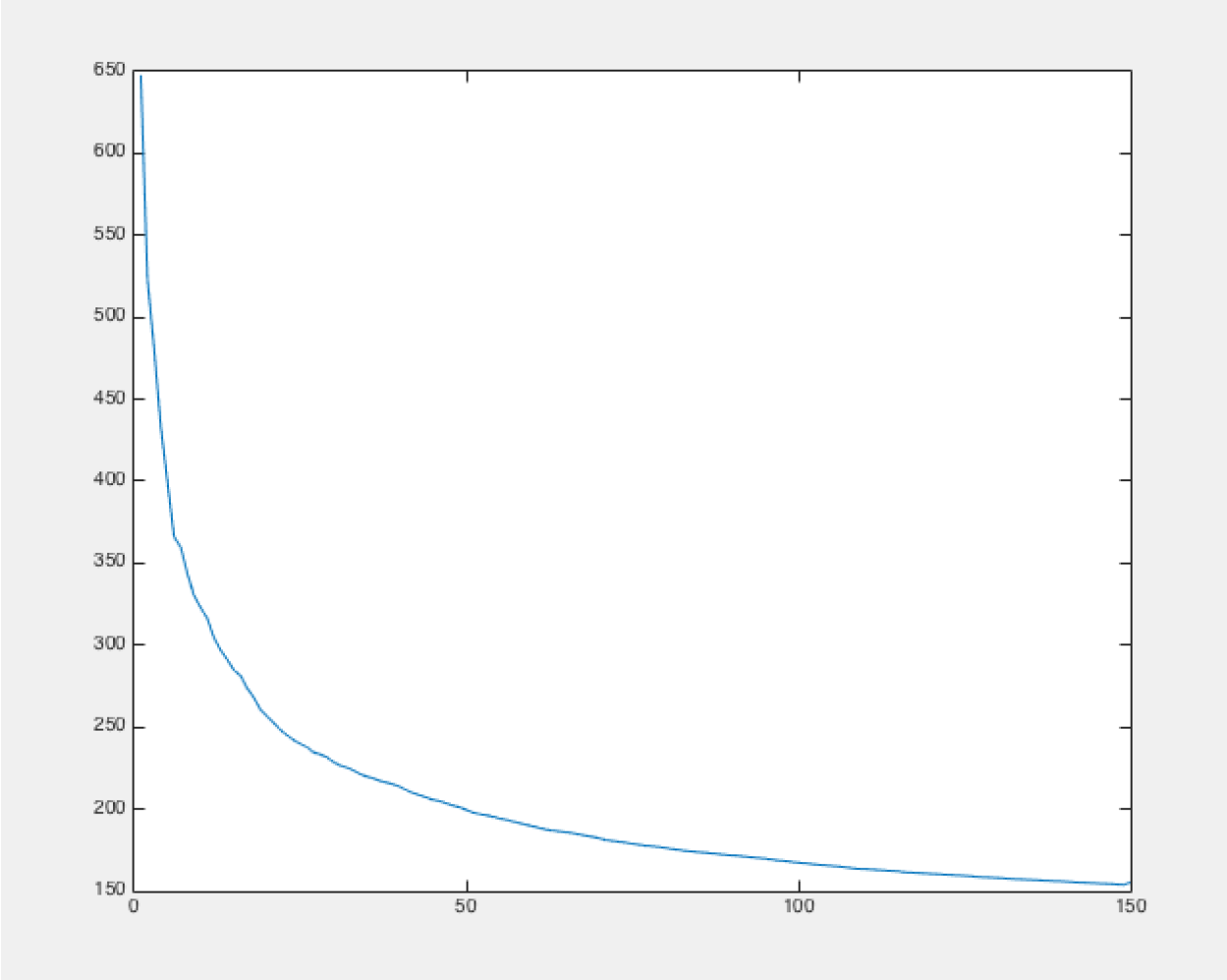
The Mean Face and the k-EigenFaces are to be computed using the Training Set with no Landmark alignment. The first K=20 eigenfaces are Displayed. These, faces from the Face Space is then used to Reconstruct the 28 test faces also. The Reconstructed Test Faces are displayed. Finally, the total Reconstruction Error (diff in intensities of Reconstructed Face and the original Test Face per pixel) of the 28 Reconstructed Test Faces(Error averaged over the Test Faces) is plotted against the number of EigenFaces taken first k at a time.

Mean Face:

Eigen Faces: for k=20

Reconstructed Test Faces: for k=20

Error-in-Test-Face-Reconstruction Curve:for all k(1:150), without Landmark Alignment

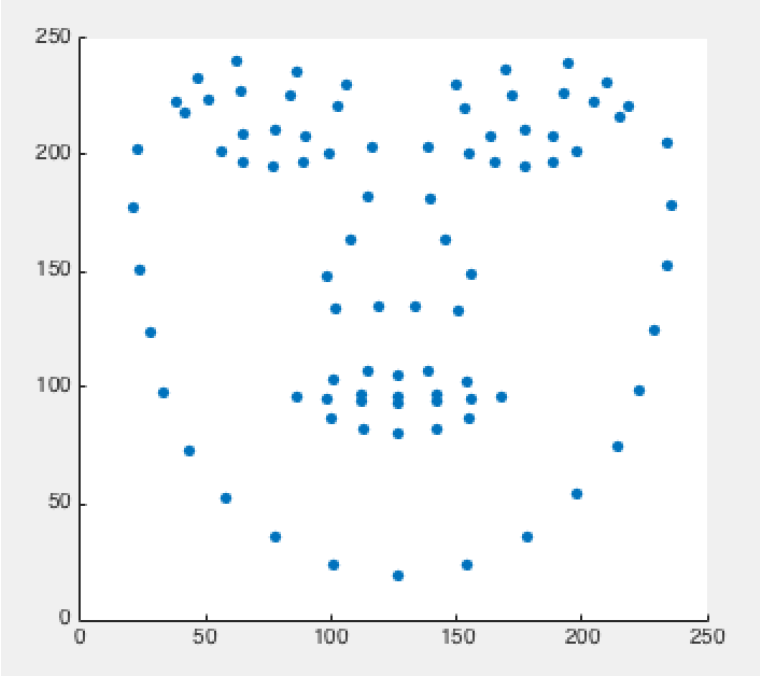


For the Question(2) of Part 1,

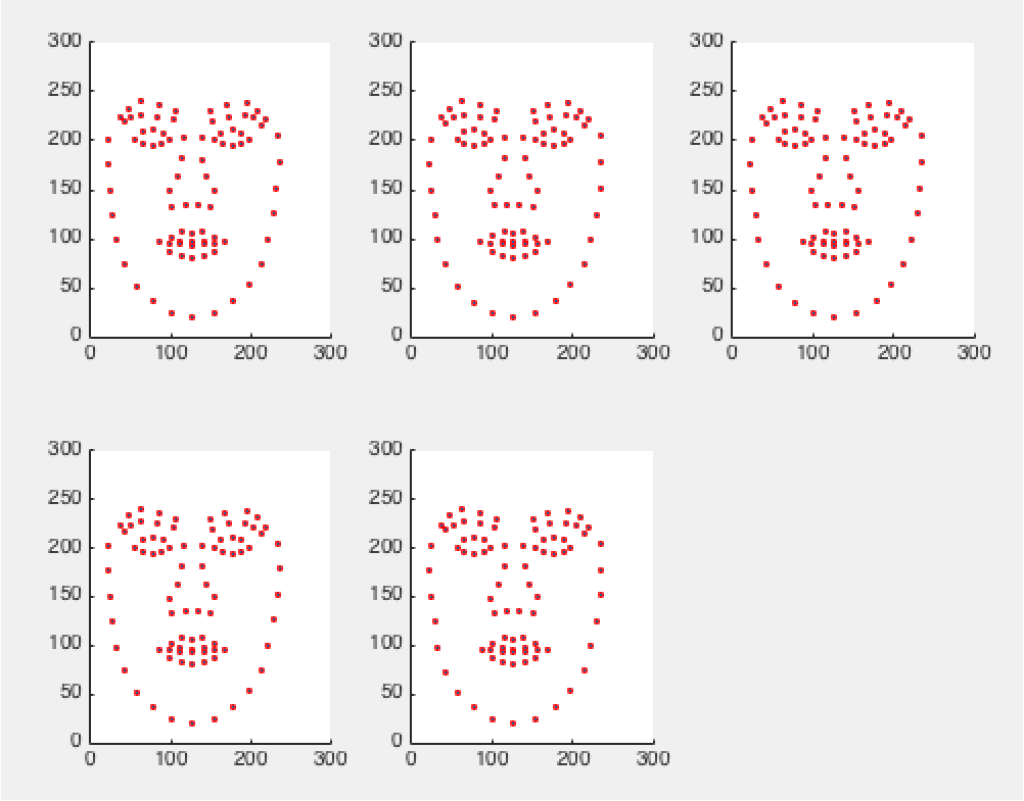
Description:

The mean Landmarks are calculated from the 150 Training set landmarks and displayed.
The top 5 Eigen landmarks are calculated from the Training set Landmarks by performing PCA.
The Eigen Landmarks from previous step are used to calculate the Reconstructed Test Landmarks. The Error in Landmarks Reconstruction is plotted for every k, per pixel and per test image.

Mean Landmarks:

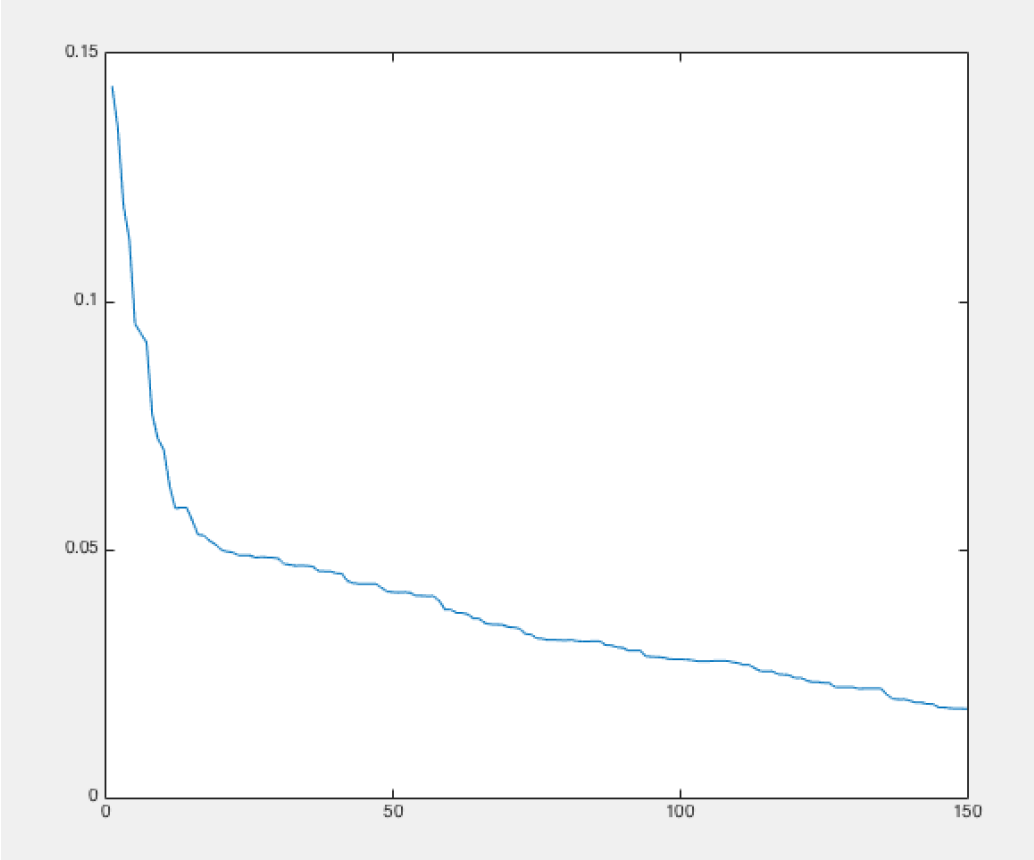


Eigen Landmarks: for k=5



Reconstructed Test Landmarks: for k=5

Error-in-Landmark-Reconstruction Curve : for all k (1:150)



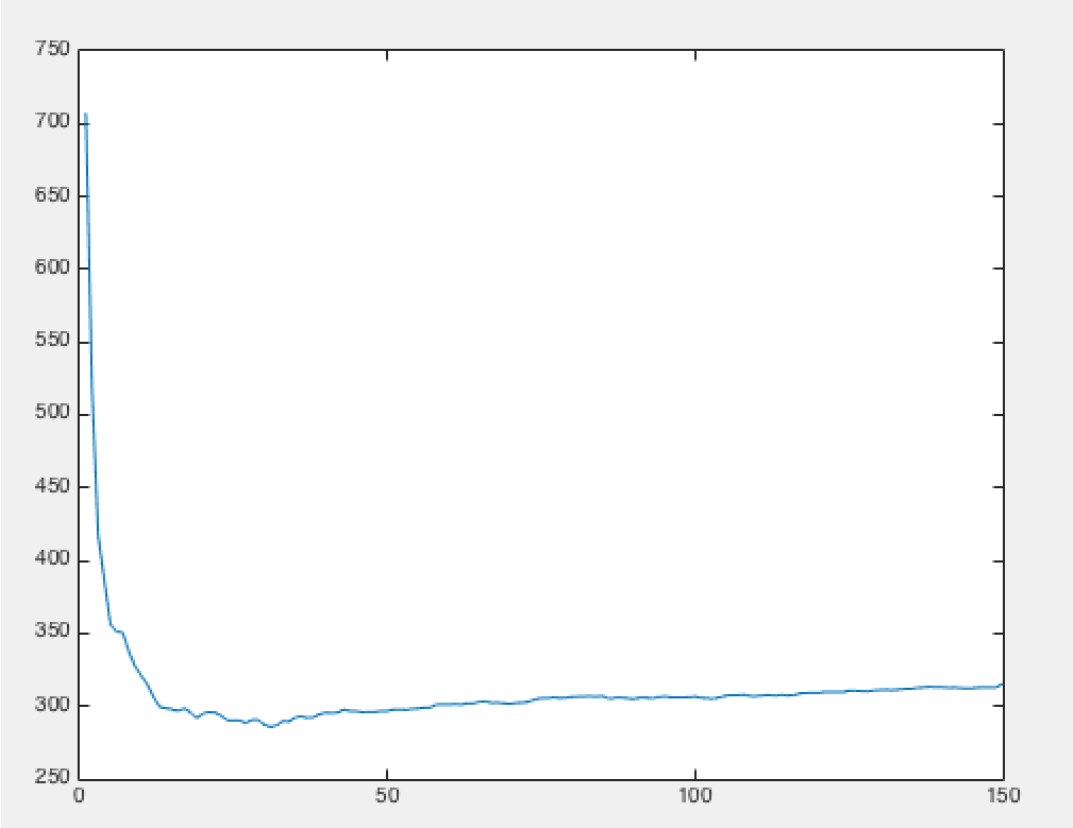
For the Question(3) of Part 1,

Reconstructed Test Landmarks: for k=10

Reconstructed Test Faces: for k=10 (Landmarks Aligned/ BEFORE Warping to Reconstructed LAndmarks)

Reconstructed Test Faces: for k=10 (AFTER Warping to Reconstructed Landmarks)

Error-in-Reconstruction Curve: for all k (1:150), Landmarks Aligned

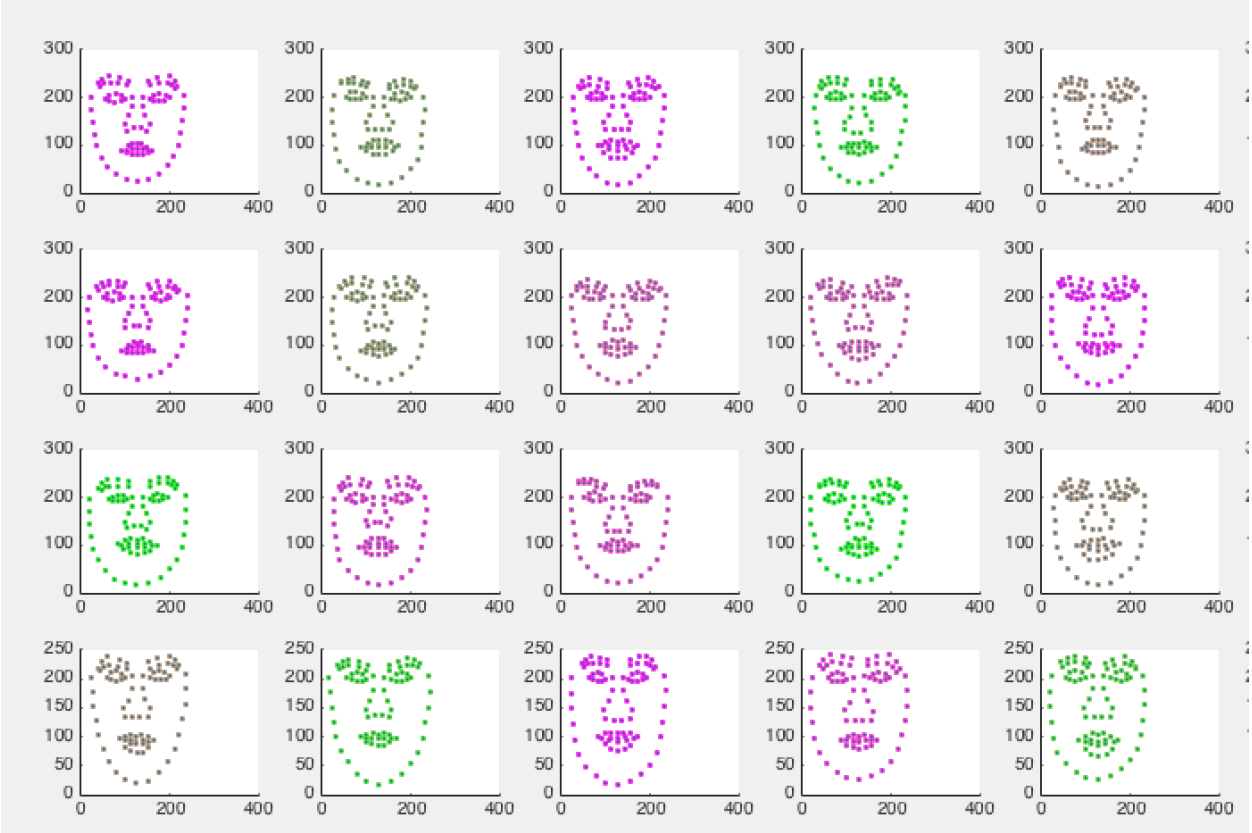


For the Question(4) of Part 1,

Description:

The 20 faces below are synthesised using a random sampling of the weights during the reconstruction procedure.

20 Synthesised Landmarks: Randomly Sampled



20 Synthesised Faces: from Randomly Sampled k=10 Eigen Values and Eigen Landmarks

20 Synthesised Faces: Another set of Randomly synthesised 20 Faces

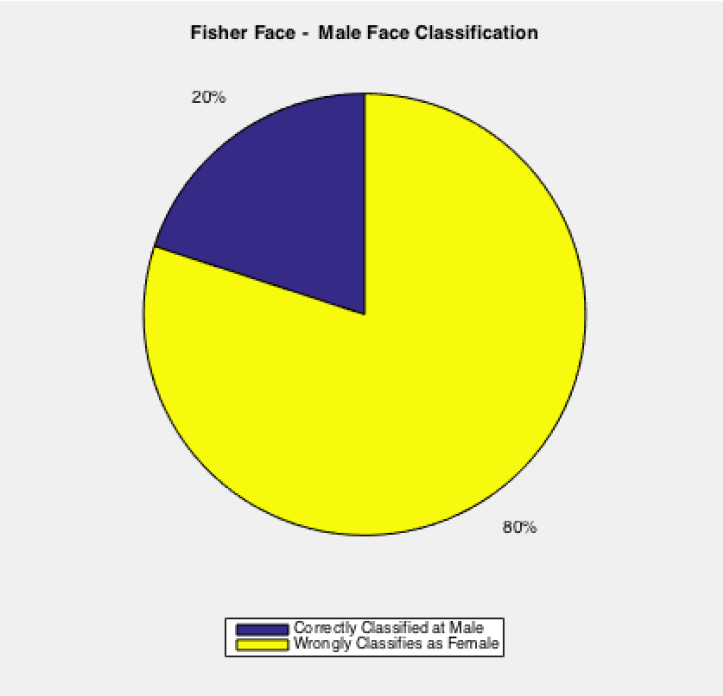
Part 2: Fisher Faces for Gender Discrimination

Given : 178 faces are divided into 88 Male Faces, 85 Female Faces and 4 Unknown Faces. Testing set is created using randomly chosen 10 faces from Male Set and 10 other from Female Set.

For the Question (5) of Part 2 -

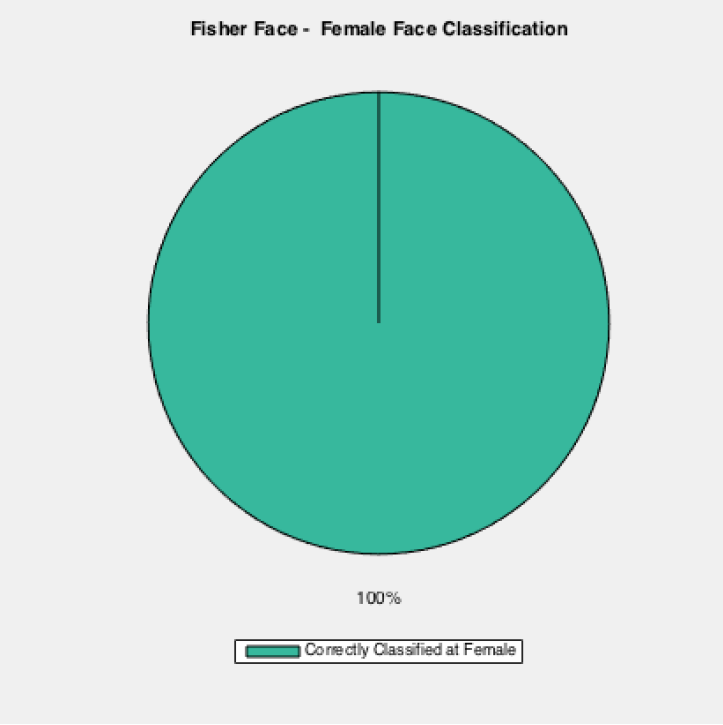
Fisher Face: for both Appearance and Geometry

Fisher Face Classification: of the Test Set of 10 Male and 10 Female Faces Shown using Pie Charts



1) Male Face Classification Success Percentage : 20%

x_male = [0.0002 -0.0075 -0.0170 -0.0147 -0.0079 -0.0042 -0.0078 -0.0124 -0.0089 0.0045]



2) Female Face Classification Success Percentage: 100%

x_fem = [0.0157 0.0147 0.0045 0.0078 0.0063 0.0094 0.0021 0.0156 0.0159 0.0223]

For the Question (6) of Part 2 -

Scatter Plot: of Appearances vs Geometry for the Male and Female TEST Images
Blue Dots: Female
Red Filled Dots: Male