

EE 657 - Pattern Recognition and Machine Learning

Term Project Report

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## Project 1:- Character Recognition using Bayesian Classifier

Using Matlab, we have built three classifiers as mentioned in the assignment

Regularization factor for all the models = 0.75

Class 1 – Character ‘e’

Class 2 – Character ‘c’

Class 3 – Character ‘l’

Model 1 – Separate Co-Variance Matrix

Model 2 – Pooled Common Diagonal Co-Variance Matrix

Model 3 – Identity Co- Variance Matrix

Table for Accuracies:

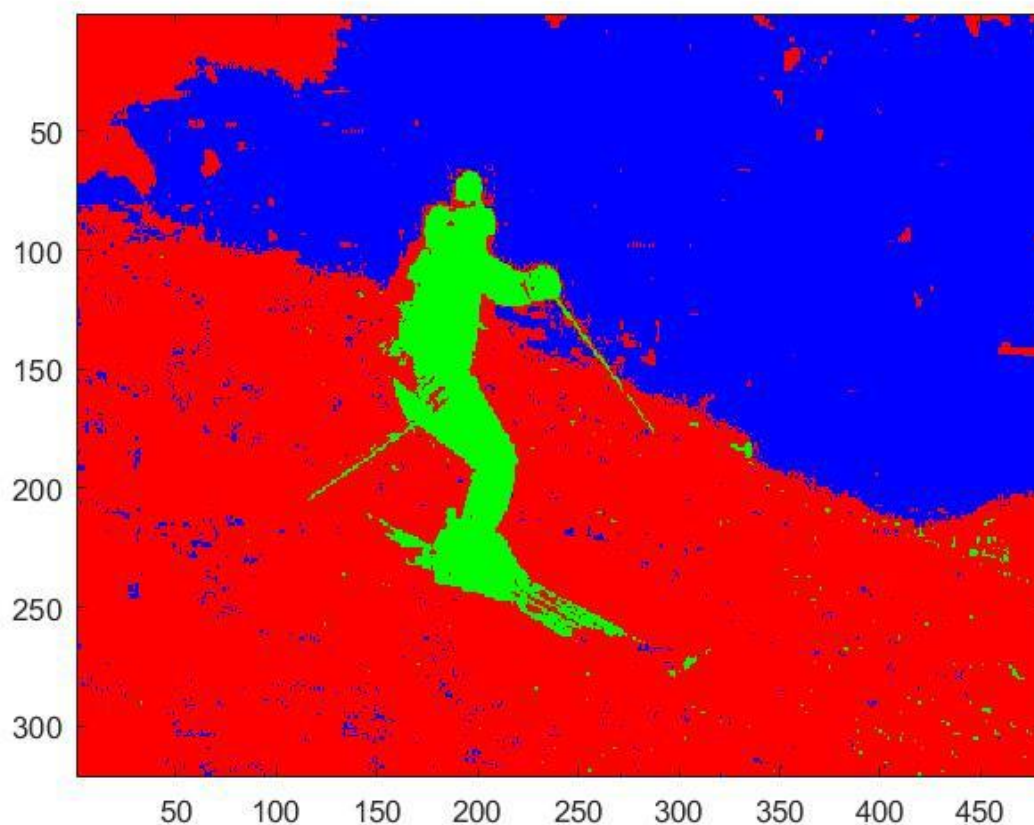
|           | Class -1 | Class - 2 | Class - 3 | Avg Accuracy |
|-----------|----------|-----------|-----------|--------------|
| Model - 1 | 88       | 90        | 100       | 92.67        |
| Model - 2 | 86       | 85        | 100       | 90.33        |
| Model - 3 | 87       | 85        | 100       | 90.67        |

## Project 2: GMM based Clustering using Expectation and Maximization Algorithm

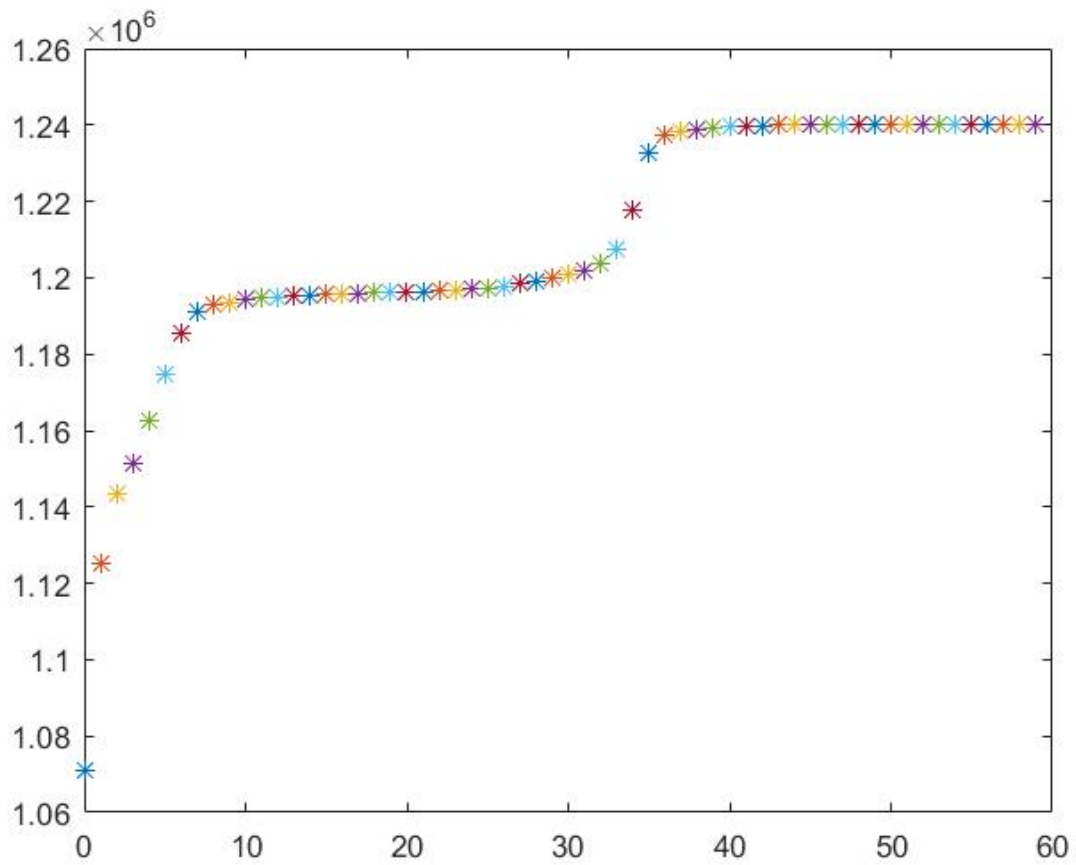
Using Matlab, We applied EM Algorithm for 60 iterations. And we got finally segmented output and convergence of log-likelihood as displayed below.

Segmented output is 321 \* 481 pixel image

### Segmented Output



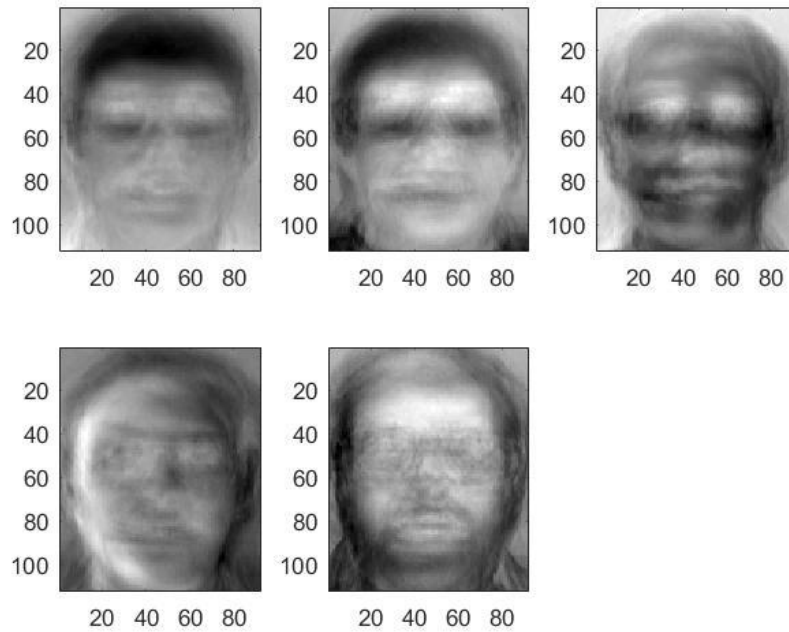
## Convergence of Log - Likelihood



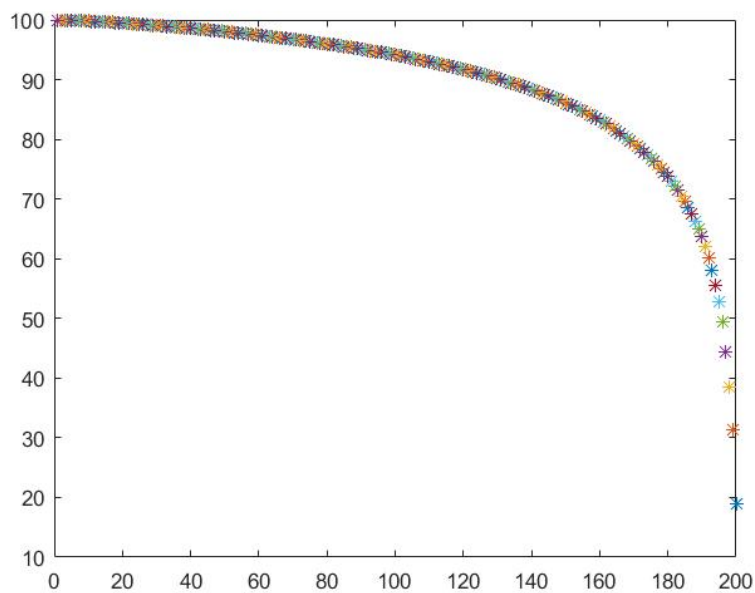
Number of iterations is 60

## Project 3 : Face Recognition using PCA

### Top 5 eigen faces



### Variance Graph



To Capture 95 percentage of variance we required top 109 eigen values

## For face Input image 1 :-

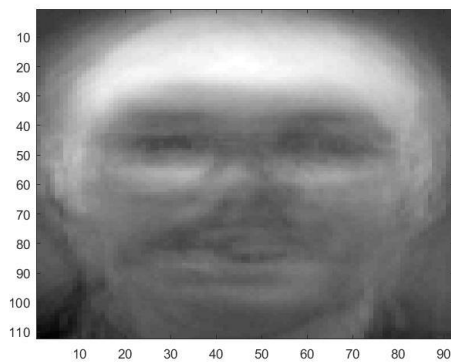
Mean Squared error for top eigen face is  $1.37137 * e^4$

Mean Squared error for top 15 eigen face's is  $1.2262 * e^4$

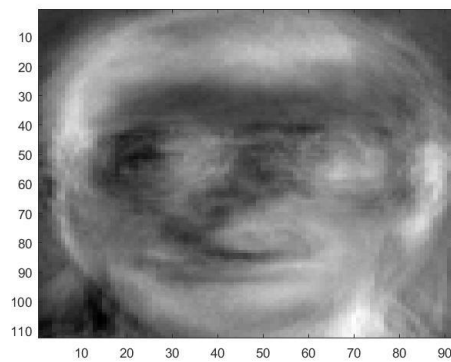
Mean Squared error for 200 eigen face's is  $1.19753 * e^4$

Reconstructed images as below:

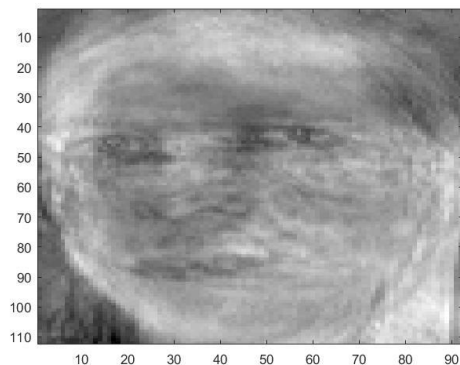
**Top Eigen face**



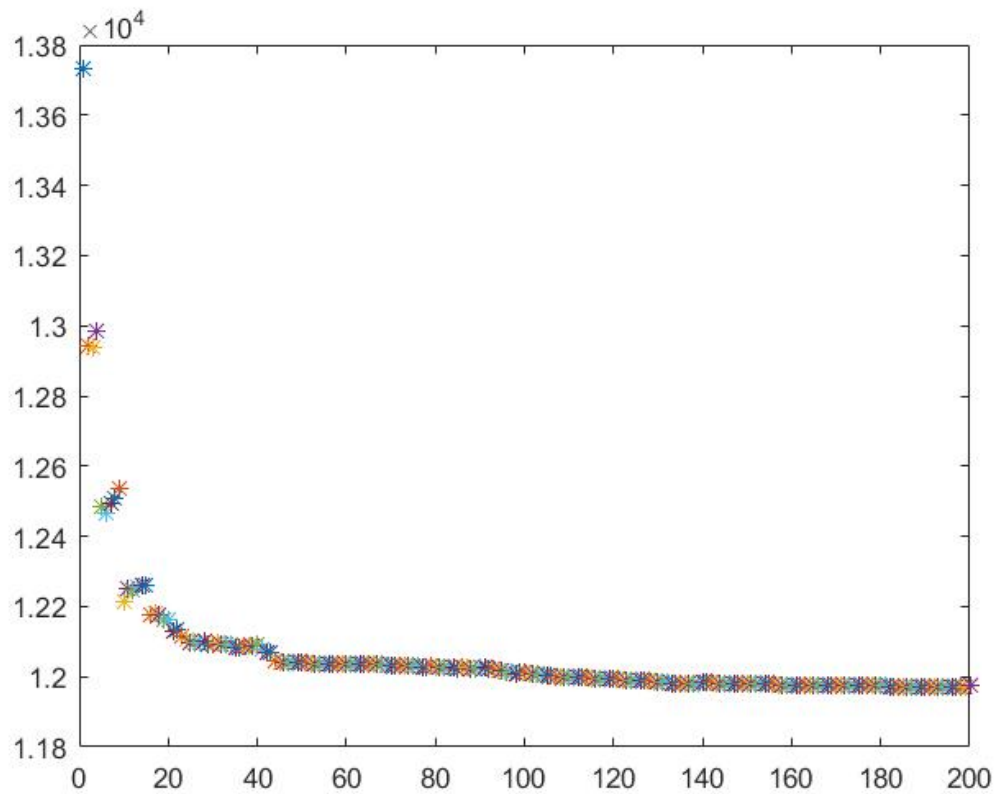
**Top 15 eigen face**



## 200 eigen faces



**Mean squared error graph for different number of eigen faces:**



## For Face Input Image 2:

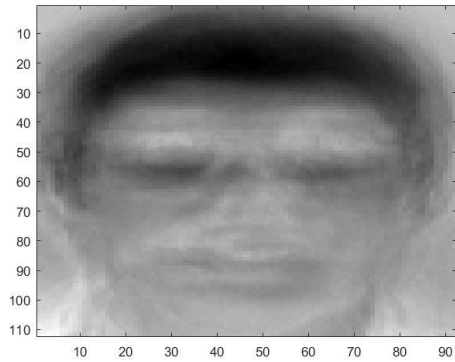
Mean Squared error for top eigen face is  $1.316397 * e^4$

Mean Squared error for top 15 eigen face's is  $1.19048 * e^4$

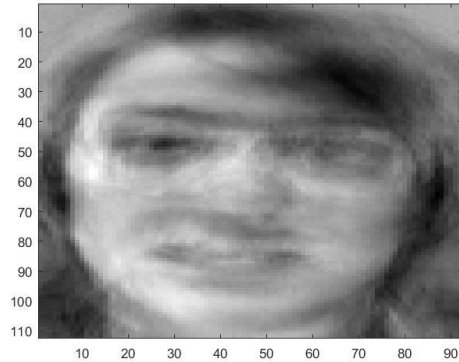
Mean Squared error for 200 eigen face's is  $1.177763 * e^4$

Reconstructed Images as below:

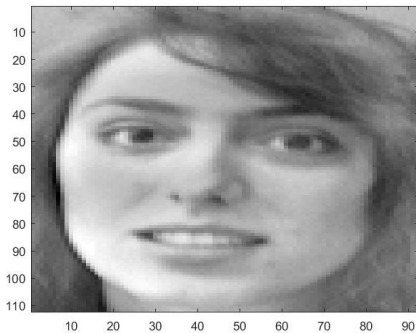
**Top Eigen face**



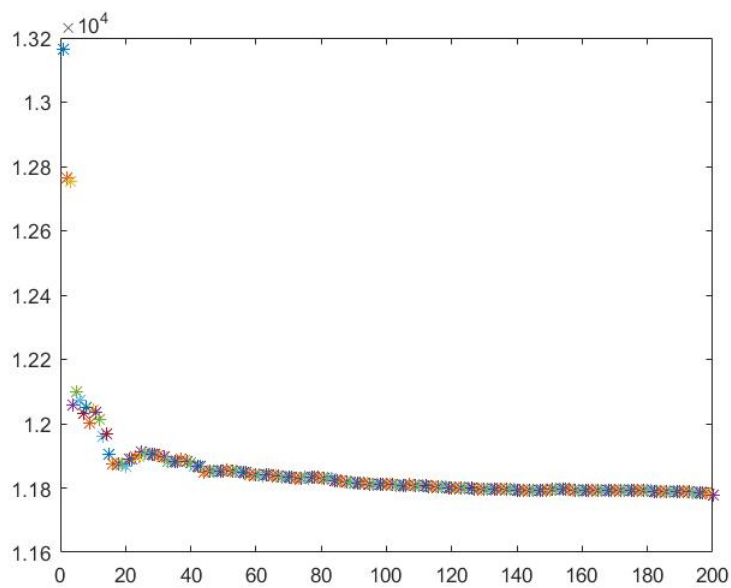
**Top 15 eigen faces**



**Top 200 eigen faces**



**Mean squared error graph for different number of eigen face:**





## Project 4: SVM using RBF Kernel function

Using python, we have built SVM.

We got maximum score as 0.95 for the parameters  $\gamma = 0.1$  and  $C = 100$

