EE-657 Pattern Recognition and Machine Learning

Assignment

Group:

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1.Character Recognition using Bayesian Classifier:

The mean and covariance matrices are estimated from the training data usin Maximum likelihood techniques.

1a)

We have taken 5 models for computing covariance matrix:

Model-1: Seperate covariance matrix for each class

Model-2: pooled covariance matrix (diagonal)

Model-3: The samples across all the classes are pooled together to get a common covariance matrix

Model-4:Identity covariance matrix

Model-5:Diagonal covariance matrix

Accuracy of individual character of each class are:

acc =

	e	c	i
Model-1:	85	89	100
Model-2:	86	85	100
Model-3:	88	96	100
Model-4:	100	100	100
Model-5:	72	71	100

Accuracy for each model is :

acc_model =

Model-1: 91.3333

Model-2: 90.3333

Model-3: 94.6667

Model-4: 100.0000

Model-5: 81.0000

1b)

Examples of samples that are misclassified in test set-1(e) in each of the classifiers:

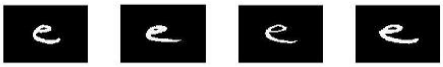
Samples misclassified using model-1:

This 4 images are misclassified as C

Samples misclassified by model-2:

This 4 images are misclassified as C

Samples misclassified by model-3:



This 4 images are misclassified as C

Samples misclassified by model-5:

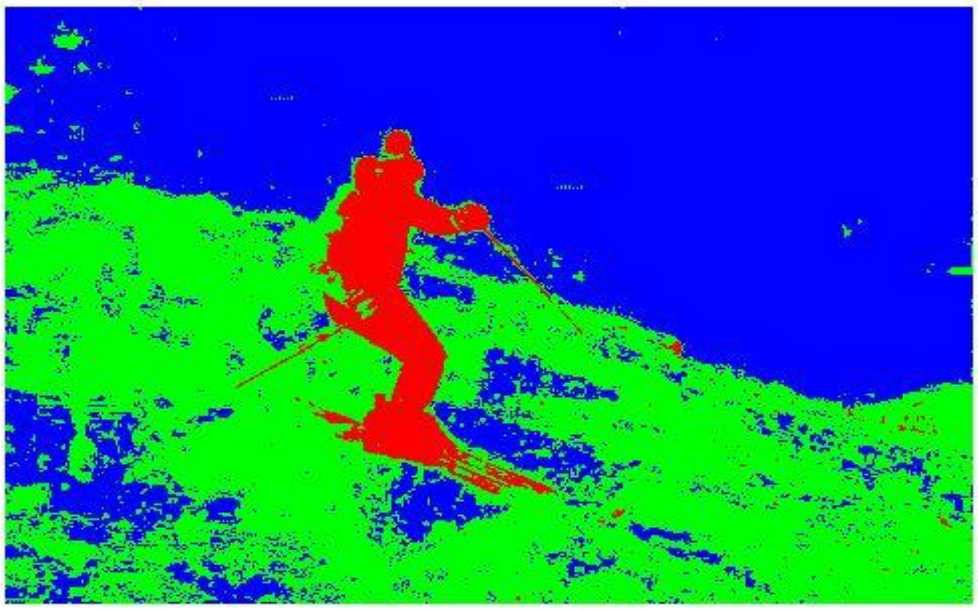
The First image is misclassified as I, Remaning 3 are misclassified as c.

2.GMM Based Clustering:

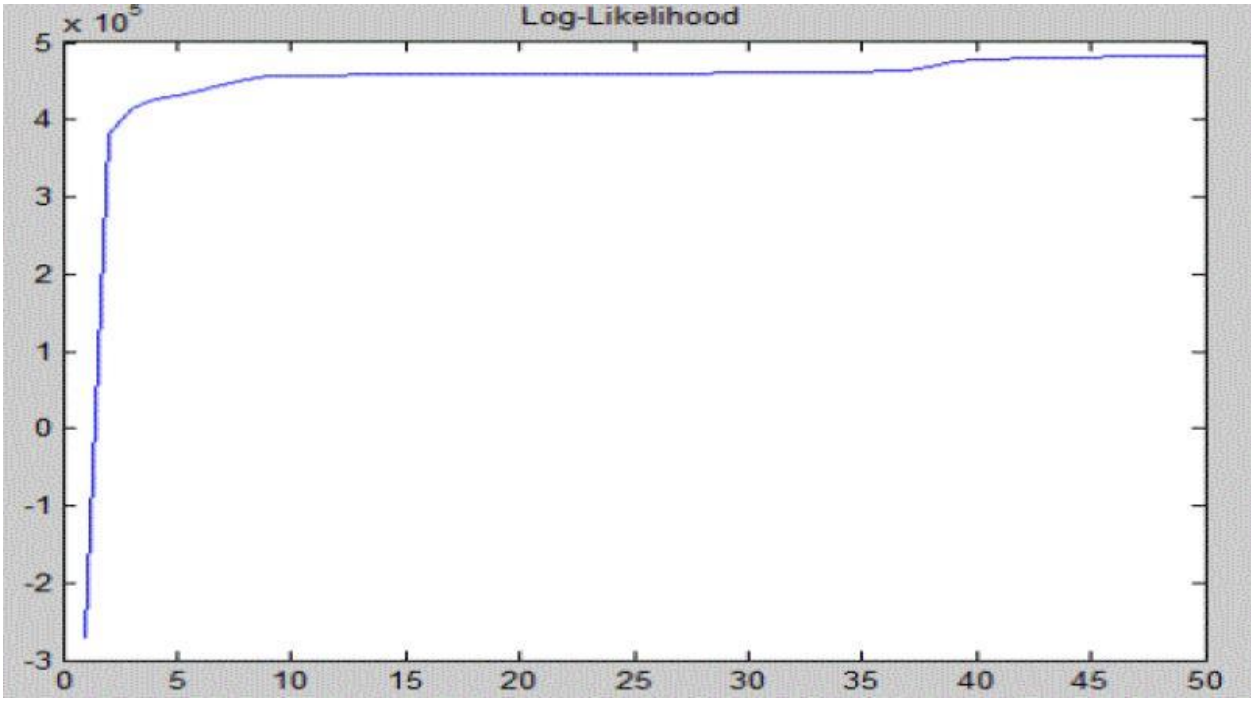
An identity covariance matrix is assumed in the beginning for each of the components.

and [pi1 pi2 pi3]=[1/3 1/3 1/3] at the start of the iteration.

After 50 iterations we got the segmented output as:



and the graph for the convergence of likelihood is:



Final values of means and covariance matrices are:

mean =

0.6074 0.2437 0.6751

0.7120 0.2773 0.7493

0.8140 0.3471 0.7964

covar1 =

0.0101 0.0096 0.0047

0.0094 0.0091 0.0046

0.0047 0.0045 0.0025

covar2 =

0.0347 0.0280 0.0286

0.0278 0.0261 0.0288

0.0286 0.0288 0.0348

covar3 =

0.0439	0.0388	0.0248
0.0388	0.0347	0.0226
0.0249	0.0226	0.0166

3. Face Recognition using PCA:

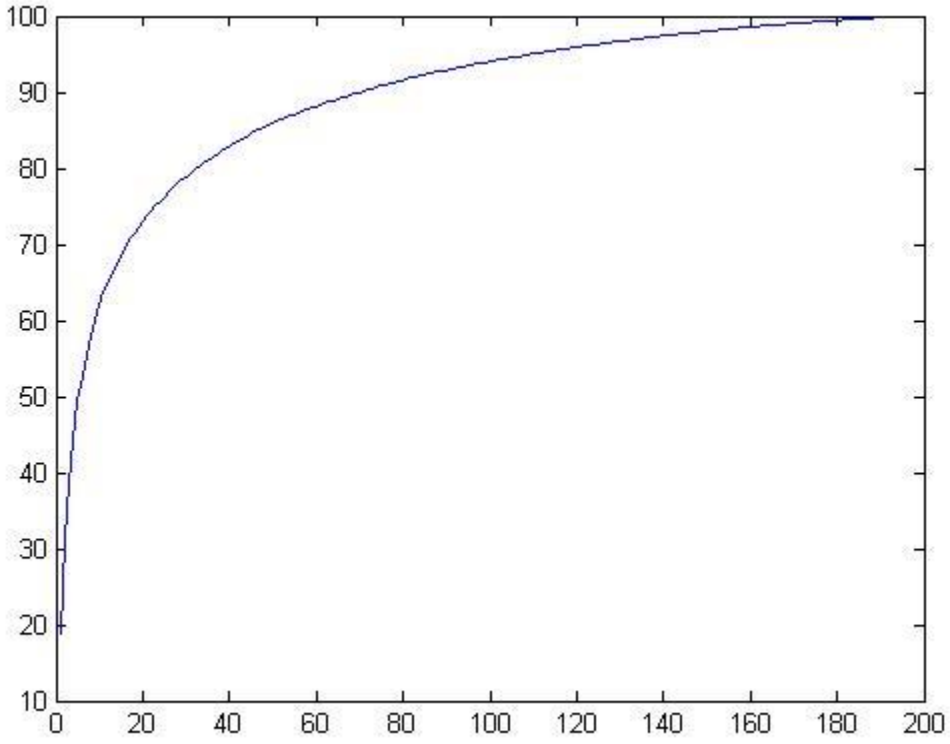
i) The eigen faces of top 5 eigen values of covariance matrix are:





ii)

Graph depicting percentage of total variance of the original data retained in the reduced space versus dimensions:



The minimum number of dimensions required for projecting the face vectors so that atleast 95% of the total variance of the original data is accounted in for the reduced space is 110.

iii)

Image of 'face_input_1.pgm' reconstructed using eigen vector of largest eigen value:

Meansquared error=0.3512

Face reconstructed using top 15 eigen faces:

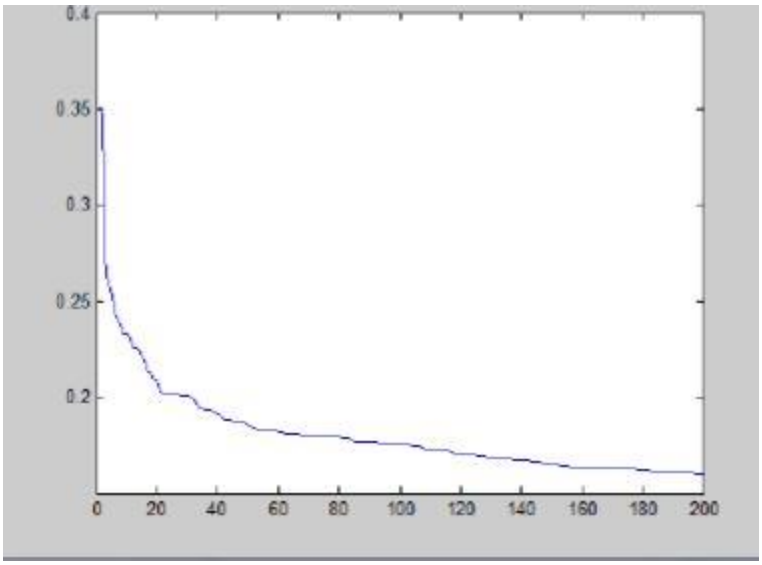
Meansquared error=0.2322

Image reconstructed using all Eigen faces:

Meansquared error=0.1499

iv)

Graph depicting meansquare error versus number of eigen faces:



v)

Image of ‘face_input_2.pgm’ reconstructed using eigen vector of largest eigen value:

Mean squared error=0.3491

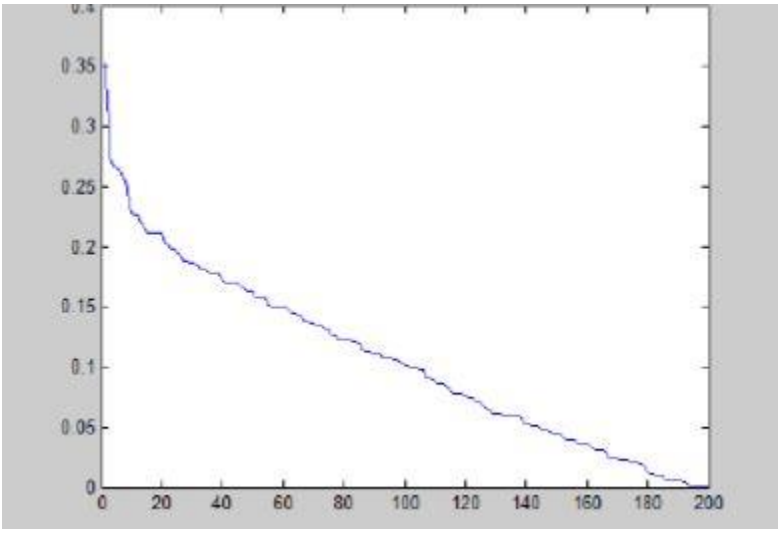
Face reconstructed using top 15 eigens:

Means squared error=0.2011

Image reconstructed using all Eigen faces:

Means squared error=0.0061

Graph depicting meanssquare error versus number of eigen faces:



4. Support vector Machines:

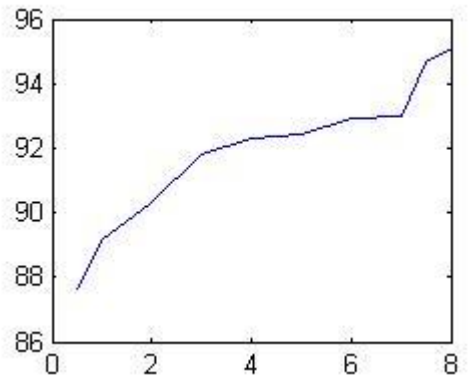
SVM classifier for the classes w1,w2,w3 was built using Radial Basis Function kernel.

The recognition accuracy on the test data Test1.mat,Test2.mat,Test3.mat for different values of penalty factors C and precisions 'gamma' of radial basis function were found as follows:

```
C=[0.5,1,2,3,4,5,6,7,7.5,7.7,8]

Gamma=[0.0625,0.125,0.25,0.5,0.5,0.5,0.5,0.25,0.5,0.54,0.55]

Acc=[87.6667,89.1667,90.3333,91.8333,88.3,90.0,91.667,93,82.667,94.667,95.10]
```



Plot depicting C vs Accuracy