

## *School of Electronic Engineering and Computer Science*

### **ECS797 Machine Learning for Visual Data Analysis**

#### **Lab 2: Face Recognition using Eigenfaces**

##### **3. Complete the lab2.m file**

1. Read in the training and test images. The two functions for loading the training and test image files have been provided in separate .m files.

2. Construct the mean image and the covariance matrix of the training image set. Code has been provided in lab2.m.

Ans: We obtained a Meanimage 28 \* 23 and covariance matrix 644\* 644 double.

3. Compute the eigenfaces of the training set. Code has been provided in lab2.m.

Ans: We obtained eigenfaces mat file 28x23 uint8

4. Display the mean image. Code has been provided in lab2.m.

#### **Mean Image**



5. Display the first 20 eigenfaces. You need to write this part of the code. Hint: take a look at the code for displaying the mean face in Step 46. Project both training images and testing images onto the first 20 eigenfaces. The function for the projection has been provided.

**1th Eigenface 2th Eigenface 3th Eigenface 4th Eigenface 5th Eigenface**



**6th Eigenface 7th Eigenface 8th Eigenface 9th Eigenface 10th Eigenface**



**11th Eigenface 12th Eigenface 13th Eigenface 14th Eigenface 15th Eigenface**



**16th Eigenface 17th Eigenface 18th Eigenface 19th Eigenface 20th Eigenface**



7. Compute the distance from the projected test images to the projected training Images.

Ans: We obtained Distances  $70 \times 200$  double

8. Display the top 6 best matched training images for each test image. Code has been provided in lab2.m.

**Image tested**



**Image recognised with 20 eigenfaces:85**



**Image tested**



**Image recognised with 20 eigenfaces:13**



**Image tested**



**Image recognised with 20 eigenfaces:18**



**Image tested**



**Image recognised with 20 eigenfaces:24**



**Image tested**



**Image recognised with 20 eigenfaces:200**



**Image tested**



**Image recognised with 20 eigenfaces:29**



9. Compute the recognition rate using 20 eigenfaces. Write your own code here.

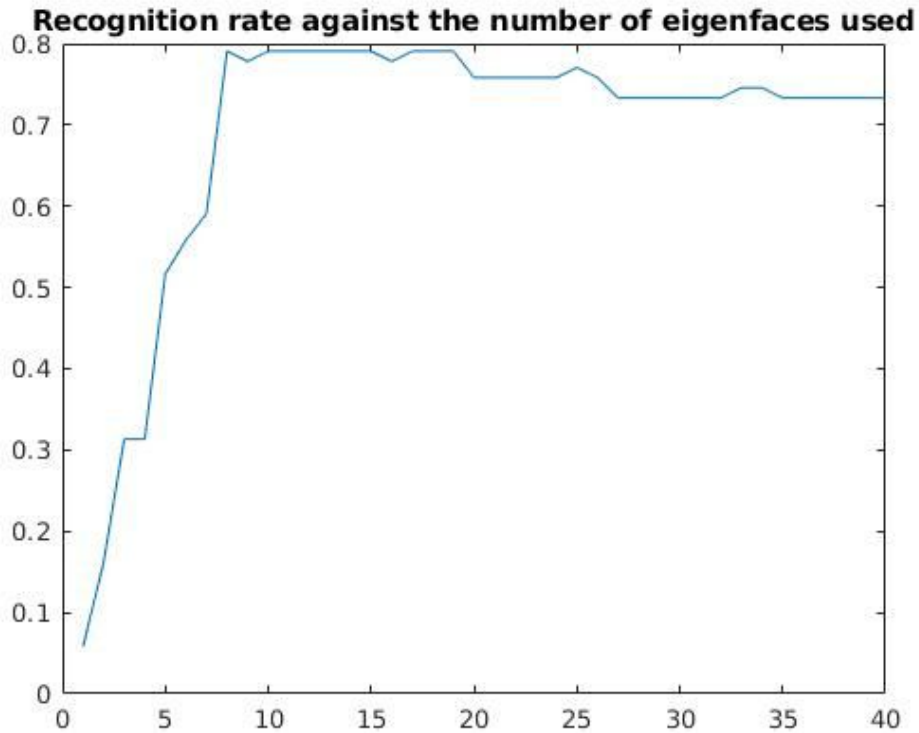
Ans : 58

Code attached in matlab file.

10. Investigate the effect of using different number of eigenfaces for recognition (e.g. plot the recognition rate against the number of eigenfaces). Code has been provided in lab2.m.

Ans: The recognition rate increases with increasing number of the eigen faces but the value decreases after 20 eigenfaces since it involves overfitting in this case.

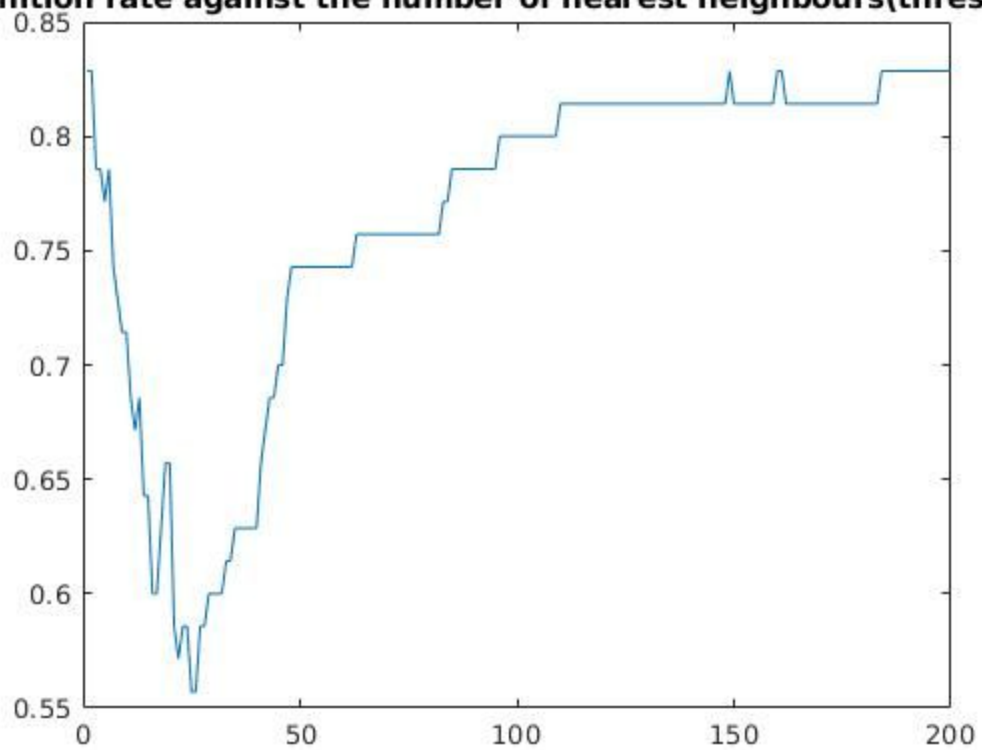
The overfitting happens with increasing number of eigenface values as can be observed below.



11. Investigate the effect of K in K-Nearest-Neighbour (KNN) classifier. Plot the average recognition rate against K). You need to write your own code here.

Ans: The recognition rate against the number of nearest neighbours first decrease till 20 and then start increasing with increasing k value as an be observed in the graph below.

**cognition rate against the number of nearest neighbours(threshold**



**Recognition rate against the number of test images (threshold=20**

