Face Recognition using PCA and LDA for Dimension Reduction

CSE 6363 Machine Learning – HW3

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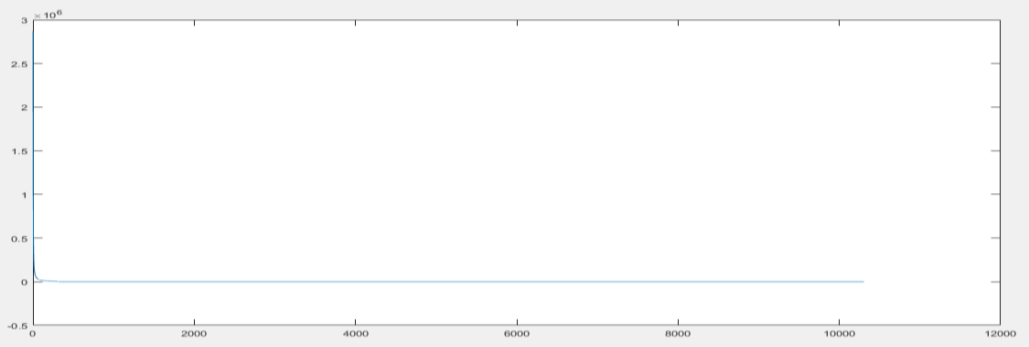
Summary:

We were given dataset of 40 subjects and each subject has 10 images.
Each image of size 112 X 92 pixels.

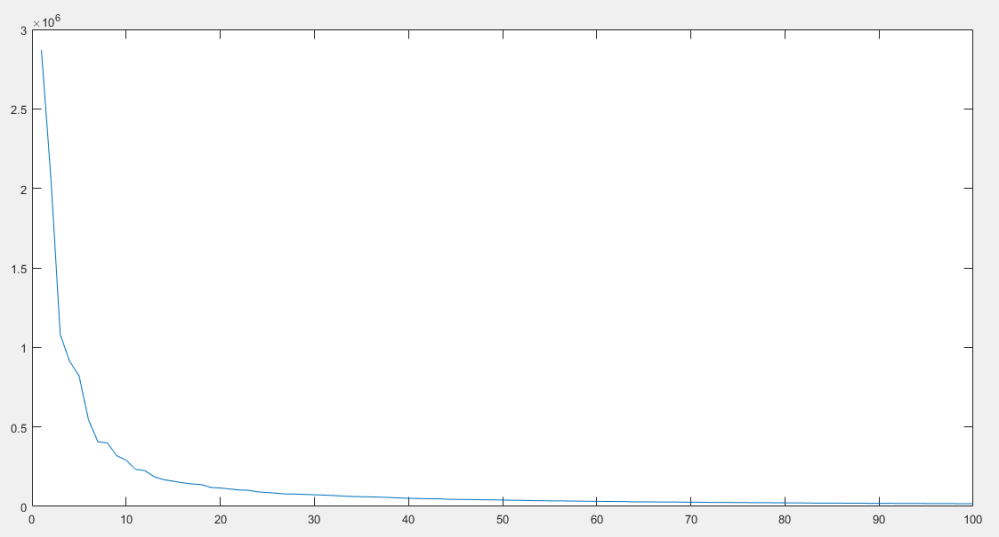
We have used 5 cross fold validation.
We have used PCA and LDA for Dimension reduction
We have used KNN and Linear SVM for classification.

6 tasks were performed and at the end using the Accuracy results from each, several conclusions are made.



When Eigen values are plotted. On taking first 100 values we can clearly see the cut out for eigen values which is k=80(For PCA)

For LDA, k=39 is considered.



Note: Graph code for PCA and LDA are written but comented since it takes about 20 min or little more to execute the code.

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Task 1:

Perform 5 cross fold validation on unresized images (112 X 92 pixels)
Normalize the images
Plot the eigenvalues, identify k (top k values that will give accuracy almost similar to original dataset)
Implement PCA for Dimension reduction
Implement 1KNN for Classification.

We achieved following result:

Executing Task 1 :

Classfold Number : 1

Accuracy of PCA : 98.75

Classfold Number : 2

Accuracy of PCA : 97.5

Classfold Number : 3

Accuracy of PCA : 98.75

Classfold Number : 4

Accuracy of PCA : 98.75

Classfold Number : 5

Accuracy of PCA : 96.25

Overall Accuracy of PCA in Task 1 : 98

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Task 2:

Perform 5 cross fold validation on resized images (56 x 46 pixels)
Normalize the images
Plot the eigenvalues, identify k (top k values that will give accuracy almost similar to original dataset)
Implement PCA for Dimension reduction
Implement 1KNN for Classification.

We achieved following result:

Executing Task 2

Classfold Number : 1

Accuracy of PCA : 98.75

Classfold Number : 2

Accuracy of PCA : 96.25

Classfold Number : 3

Accuracy of PCA : 98.75

Classfold Number: 4

Accuracy of PCA : 98.75

Classfold Number: 5

Accuracy of PCA: 96.25

Overall Accuracy of PCA on Resized image in Task 2: 97.75

Ans: From the above result, found out that the resized image dataset gives accuracy 0.25 less than the unresized image dataset.

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Task 3:

Perform 5 cross fold validation on unresized images(112 X 92 pixels)
Normalize the images
Plot the eigenvalues ,identify k(top k values that will give accuracy almost similar to original dataset)
Implement LDA for Dimension reduction
Implement 1KNN for Classification.

We achieved following result:
Executing Task 3:

Classfold Number : 1

Accuracy of LDA in Task 3 : 96.25

Classfold Number : 2

Accuracy of LDA in Task 3 : 97.5

Classfold Number : 3

Accuracy of LDA in Task 3 : 98.75

Classfold Number : 4

Accuracy of LDA in Task 3 : 96.25

Classfold Number : 5

Accuracy of LDA in Task 3 : 96.25

Overall Accuracy of LDA in Task 3 : 97

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Task 4:

Perform 5 cross fold validation on unresized images(112 X 92 pixels)
Normalize the images
Implement PCA for Dimension reduction where K=320
Plot the eigenvalues ,identify k(top k values that will give accuracy almost similar to original dataset)
Implement LDA for Dimension reduction
Implement 1KNN for Classification.

We achieved following result:

Executing Task 4:

Classfold Number : 1

Accuracy of LDA in Task 3 : 95

Classfold Number : 2

Accuracy of LDA in Task 3 : 93.75

Classfold Number : 3

Accuracy of LDA in Task 3 : 92.5

Classfold Number : 4

Accuracy of LDA in Task 3 : 98.7

Classfold Number : 5

Accuracy of LDA in Task 3 : 96.25

Overall Accuracy of LDA in Task 3 : 95.24

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Task 5:

Perform 5 cross fold validation on unresized images(112 X 92 pixels)
Normalize the images
Implement Linear SVM for classification.

We achieved following result:

Executing Task 5

Classfold Number : 1

Accuracy of LSVM in Task 5 : 98.75

Classfold Number : 2

Accuracy of LSVM in Task 5 : 100

Classfold Number : 3

Accuracy of LSVM in Task 5 : 100

Classfold Number : 4

Accuracy of LSVM in Task 5 : 97.5

Classfold Number : 5

Accuracy of LSVM in Task 5 : 97.5

Overall Accuracy of LSVM on cross validation in Task 5 : 98.75

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Task 6:

Perform 5 cross fold validation on unresized images(112 X 92 pixels)
Normalize the images
Plot the eigenvalues ,identify k(top k values that will give accuracy almost similar to original dataset)
Implement PCA for Dimension reduction
Implement Linear SVM for Classification.

We achieved following result:

Executing Task 6

Classfold Number : 1

Accuracy of LSVM with PCA in Task 6 : 97.5

Classfold Number : 2

Accuracy of LSVM with PCA in Task 6 : 98.75

Classfold Number : 3

Accuracy of LSVM with PCA in Task 6 : 100

Classfold Number: 4

Accuracy of LSVM with PCA in Task 6 : 98.75

Classfold Number: 5

Accuracy of LSVM with PCA in Task 6 : 96.25

Overall Accuracy of LSVM on PCA data in Task 6 : 98.25

Conclusion:

From the above task it can be concluded that Linear SVM used provided better accuracy than 1KNN in classification.