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Technical Report - SMAI-Assignment-2

1. Eigen Faces:

a. Eigen faces are the name given to set of Eigen vectors that are used in computer vision for solving the problem of face recognition. It is derived from the covariance matrix of the dataset.

b. To calculate the number of Eigen vectors required to satisfactorily reconstruct a person, We use the formula.

((∑eigval(i), i=1…k)/ (∑eigval(i), i=1…N)) ≥ 0.9

i :- Index
N :- Total number of Eigen values
k :- An integer less than N, integer which is to be determined.

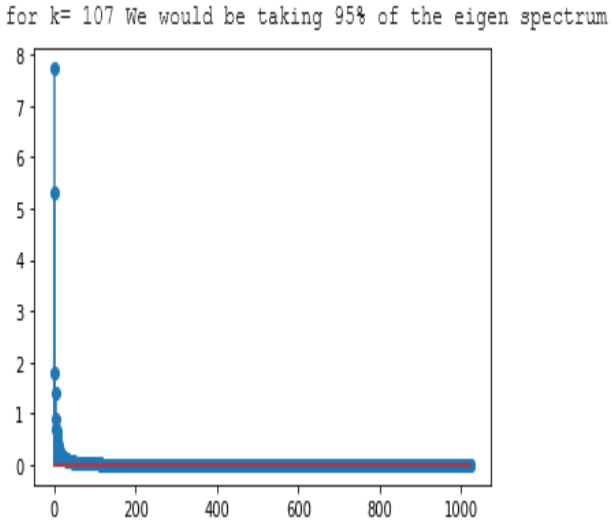

Fig-1 Eigen value spectrum of dataset Yale Face Database, k=107

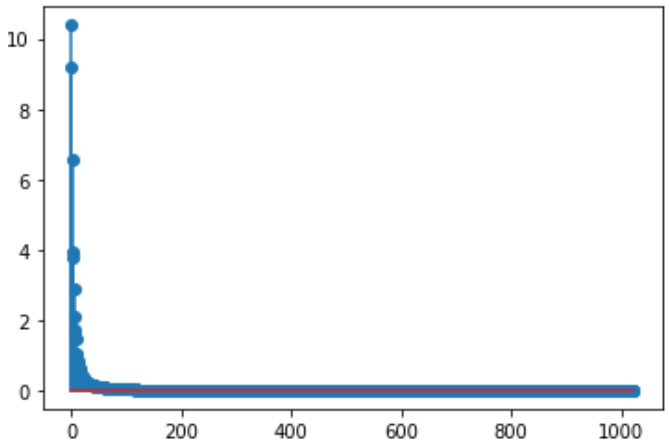

Fig-2 Eigen value spectrum of dataset IFMDB Face Database, k=60

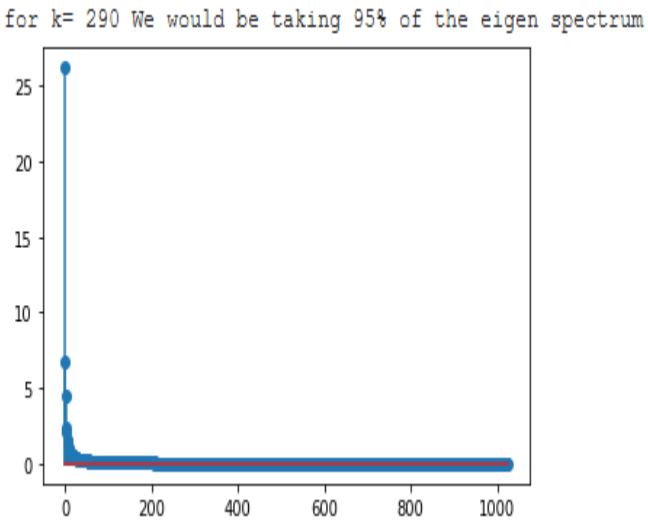

Fig-2 Eigen value spectrum of dataset IIT-CFW Face Database, k=290

c. We can determine difficulty of the representation of a class by calculating the reconstruction loss.

Order of the worst represented classes for various datasets is as follows:

1. Dataset IMFDB :- 6 0 5 3 2 4 7 1

2. Yale face database :- 7 6 5 4 1 3 2 0

2. Classification based on 6 different feature reduction :

For Yale Database, all the 6 features are compared for classification and following table lists the accuracies obtained. MLP Classifier with 1024 hidden layers, 250 batch size and 50 iterations used for classification. Classifier trained on the features obtained from each feature reduction method.

	Features	reduced storage	Accuracies
0	Eigen Face	61	0.909091
1	Kernel Face	8	0.363636
2	Fisher Face	32	0.939394
3	Fisher kernel face	7	0.939394
4	vgg	165	0.424242
5	resnet	165	0.969697

Tabel-1: Accuracy scores obtained from different features with MLP Classificaiton.

From above table it is observed that, Fisher Kernel face i.e Kernel LDA provides the highest accuracy with least number of features.

Confusion matrix with kernel LDA with same number of features is created for other two datasets. But similar accuracy is not obtained for other two data sets.

3. t-SNE method for brining similar people together

a. It is observed that, by applying the LDA or Kernel LDA before applying the t-SNE, it is possible to bring the similar people together.

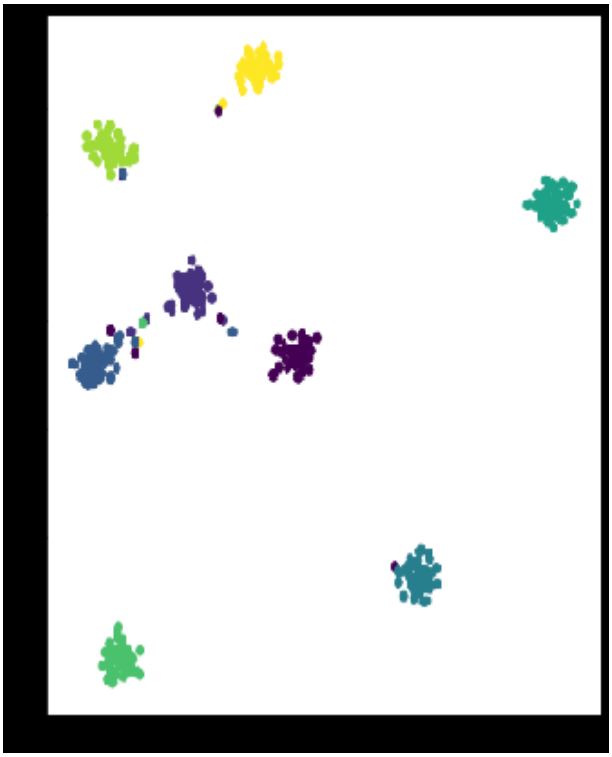

Fig – 4: Scatter plot of t-SNE on the LDA feature.

4. Face for Verification of Face and Class ID:

KNN Classifier with K of 7 is used on IMFDB database to verify the Face vs Class ID.

KNN is trained initially and validated with valid data.

Later Classifier is tested with the test data. It is observed that 68% accuracy obtained with the K = 7. It is observed that accuracy improves with the K value further reduced.

5. One problem Gender prediction is selected.

Both the IMFDB and IIIT-CFW databases are combined.

Labeling is changed to identify male and female of persons in the database.
With new labels, Test data, training data and validation data are generated with the combined data base.

LDA classification is used for classifying the Male and Female.

99% of validation accuracy and 65 % test accuracy is obtained.

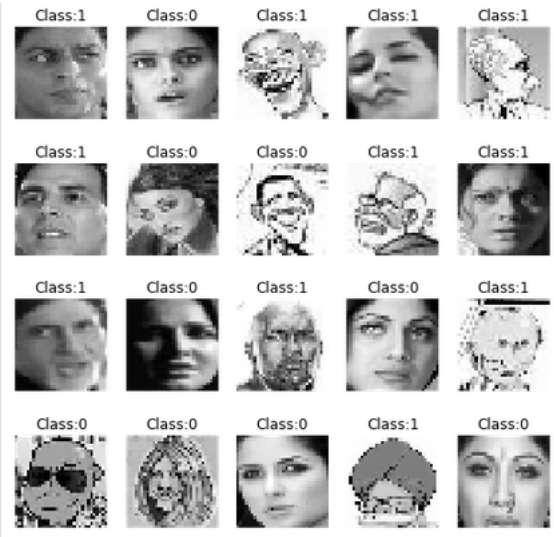

Fig-5 Predicted samples of test data on classifer. Class – 0 : Female, Class-1: Male

6. My Own Problem:

I have selected the problem of Face Expression recognition is selected.

As the face expressions for same emotion also varies from person to person, it is not trivial.

Database of 7 different classes of emotions are downloaded from internet.

LDA feature reduction, PCA with MLP classification experimented for obtaining the classification of data into different classes. Both the methods has given less than 35 % accuracy.

A deep neural network with more training data required to improve the accuracy.

Confusion matrix, accuracy score, classification report are generated.

By classifying the face expressions on the images will be useful for post analysis of criminal cases for understanding the emotional status of the people involved.

A real time face expression recognition can be used for helping the un-attended elderly people and children.

A real cognitive feature in AI is possible by obtaining the emotion recognition.

Conclusion:

Feature reduction technique to obtain the Eigen faces is useful to identify the number of import features are essential for reconstruction or classification of image with significant reduction in feature space. Classification (MLP) is implemented on different feature reduction techniques and obtained best results for kernel LDA for one data set. But, similar accuracies were not obtained for other data sets. These techniques are several applications in real time in day to day life.