PRINCIPAL COMPONENT ANALYSIS BASED FACE RECOGNITION SYSTEM

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Abstract: In this paper, a face recognition system using the principal component analysis (PCA) algorithm was executed. Face recognition is an important and challenging field in the computer world. In this paper a system is present which is able to recognize a person's face by comparing the facial structure to another person, which is consummated by using front view photographs of individuals in 2-dimensional representation of a human head. Various types of techniques are used for pre-processing the image in order to handle face alignment problems. Eigen faces are eigenvector of covariance Matrix, represents the given image. And then any new image can be represented as linear combination of these Eigen faces. The techniques classified the faces 97% correctly.

Index words: PCA, Eigen faces, face recognition, eigenvectors.

I. Introduction

Now a days face recognition plays an vital role in many aspects such as presence system, security and access system, and identification system. Face recognition is effective and efficient. The face is the predominant cornerstone of surveillance in the society, which plays a crucial role in conveying sameness and emotion. Face recognition is quite challenging but the human ability to recognize individuals is incredible. A human can identify thousands of faces throughout the lifetime and can recognize familiar faces at a glance even after the separation of years. This mastery in humans is quite robust, despite of large changes in the views, expressions, aging and distraction. The identification of focus or recognitions of faces are properly identified through a reduced technique called principal component analysis (PCA). In this technique the original matrix is being converted to the reduced matrix and the problem is solved using various mathematical techniques. The implemented matrix is again converted to the original matrix and finally the image is being identified. The system functions by projecting face images on to a feature space that spans the significant variations among the known face images.

II.RELATED WORK

After preparing the dataset, the next task is to load the dataset in MATLAB. To load the dataset the function of the MATLAB must be implemented. Anyone can use this function to load other dataset as well. Let's name it 'load_database.m'. The code is available in the link.n the first line, the declaration of function is there named load_database. We cannot input any values since its contains empty parenthesis. But it can return the numeric form of images. The images will be stored in a variable named output_value..Assume two more variables named 'loaded' and numeric_images. The variables we considered are persistent in nature..The persistent variables are local to the function in which they are declared, yet their values are retained in memory between calls to the function. Persistent values are similar to the global variables because MATLAB permanent storage of both. They differ from global variables in that persistent variables are known only to the function in which they are declared. This prevents persistent variables from being changed by other functions or from the MATLAB. After that the loaded variable is checked whether it is empty or not by using if condition. If the loaded variable is empty we will load the dataset. The persistent variables permanently store the data. Only once the dataset will be loaded so, the loaded variable must be empty at the beginning.

To recognize the faces, first the dataset is loaded. After that using the random function generated a random index. Using the sequence of random index, loaded the image which will be recognized later. All the images are also loaded into the separate variable. After that we calculated the mean of all the images and subtracted the mean from them. The images eigenvectors are calculated. Having the Eigen values created a matrix where each row contains the signature of individual images. Signature of the images and Eigen values are to identify them. At last we subtracted the mean value from the image which is to be recognized. Again multiplied it with the eigenvector based on the difference between current image signature as mentioned above, finally predicted the recognized image.

III.PROPOSED MODEL

We have to find the mean of the Data Matrix. Calculate the eigenvectors and Eigen values of the covariance matrix. Since the covariance matrix is square, we can calculate the eigenvectors and Eigen values

$$\text{Mean is } \bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

These are rather important, as they tell useful information about our data. Eigen Vectors & Eigen Values where one thing to notice is Eigen Values are different values. It turns out that the eigenvector with the highest Eigen value is the principal component of the whole data set Let A be a square matrix. A non-zero vector C is called an **eigenvector** of A if and only if there exists a number (real or complex) **λ** such that

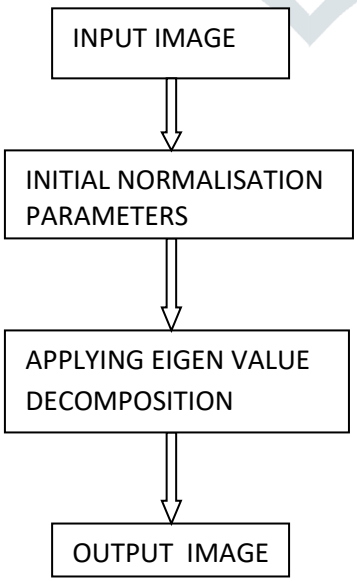
$$AC = \lambda C.$$

Eigen Value of the Covariance Matrix:

$$\begin{pmatrix} -0.0000 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -0.0000 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -0.0000 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.0000 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.0000 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.0000 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.0000 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.0000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 3.4673 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 39.1993 \end{pmatrix}_{10 \times 10}$$

Eigen Value in sorted order:

$$\begin{bmatrix} -0.0000 & -0.0000 & -0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 3.4673 & 39.1993 \end{bmatrix}_{1 \times 10}$$



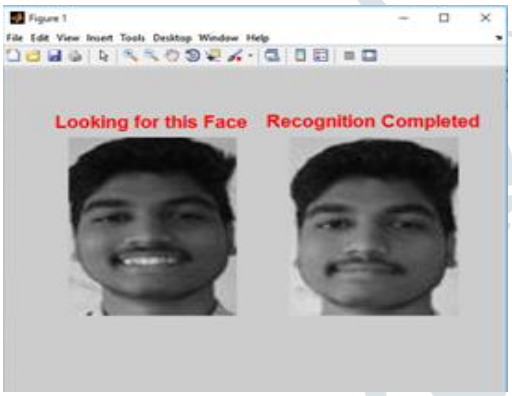
[fig1: Proposed model for face Recognition]

The Euclidean is often the "default" distance used in e.g., K-nearest neighbors (classification) or K-means (clustering) to find the "k closest points" of a particular sample point. Another prominent example is hierarchical clustering, agglomerative clustering (complete and single linkage) where you want to find the distance between clusters.

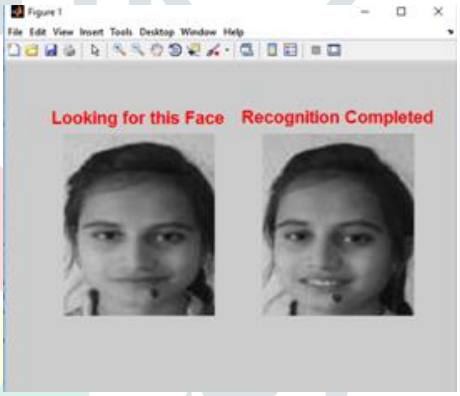
$$\sqrt{\sum_{i=1}^{n}(q_i - p_i)^2}.$$

Results And Discussion

Experimental work was designed to compare the face one with another. First the dataset is being prepared though the dataset is prepared automatically. We represented manually for the better understanding of the users what is actually happening with the system we prepared. The loading of dataset in MATLAB is shown here.

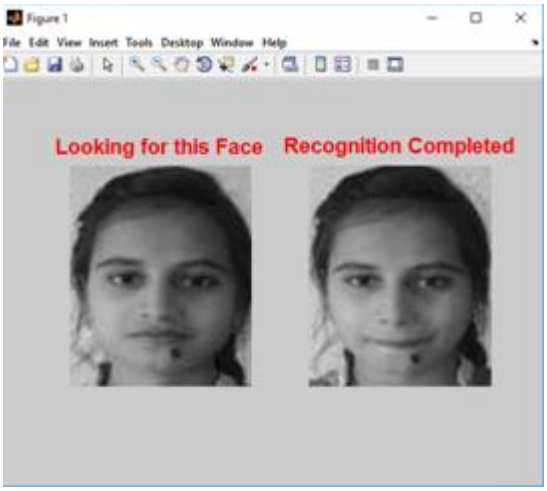


[*Figure 2: face matching image1]*

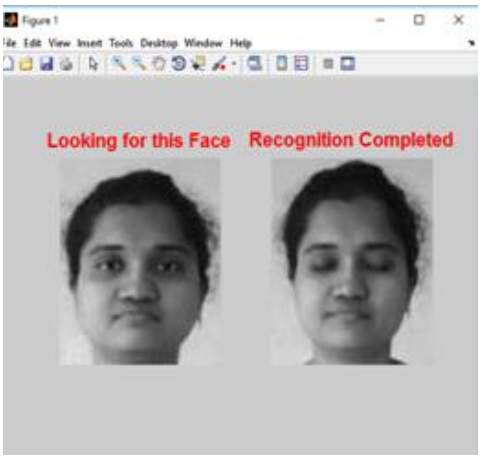


[*Figure 3: face matching image2]*

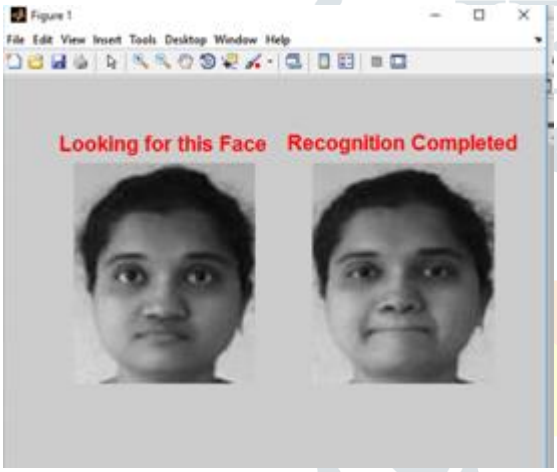
We have prepared the dataset of 20 people each of them has 4 images. These images are in grayscale. The images must be with same dimensions and resolution .Images of every individual are loaded into separated folder. In the figure 1.1, the s1, s2, s3 _____s4 represents the folder respectively. Hopefully the structure of the dataset is understood.



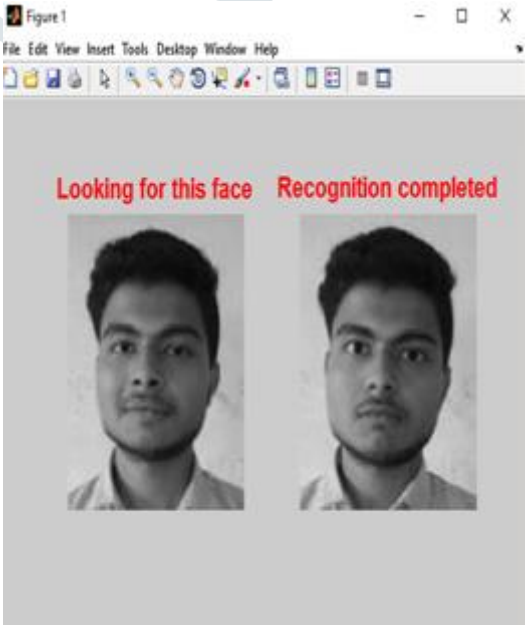
[Figure 4]



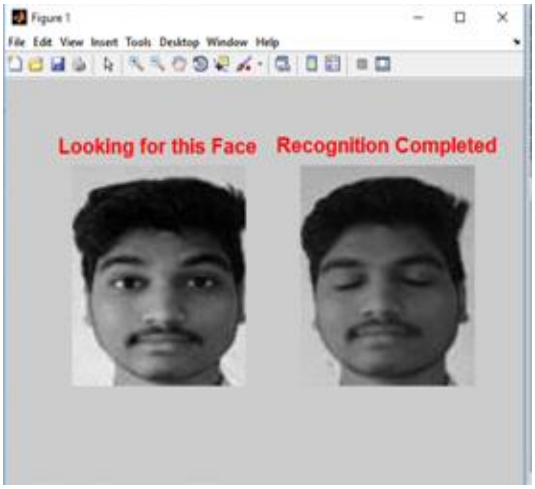
[Figure 5]



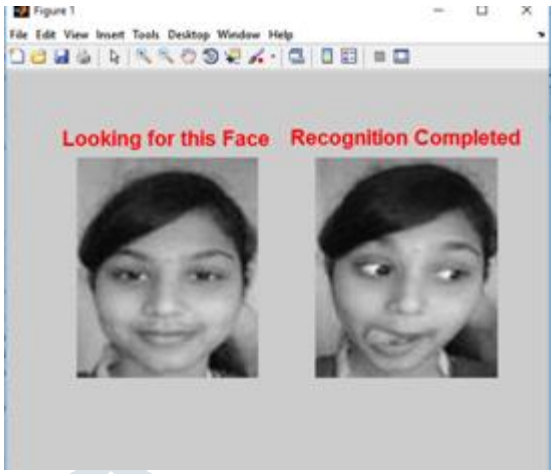
[Figure 6]



[Figure 7]



[Figure 8]



[Figure 9]

[Figure 10]

Figures and tables

Total images	Total classes	Error	Recognition rate
25	5	3%	97%

[Table 1: Face recognition rate]

CONCLUSION

In this paper eigenfaces based face recognition has been implemented. The PCA for the face recognition is fast and simple. In this paper we used database of face images which contain the images of various persons. By using eigenface approach, the image is recognized even though the images had minute changes as compared to the original image present in the database. we used face images as a face database.Thus, the steps used in the project are quite adequate.

Acknowledgements

This system can be used in many aspects for the security purpose like student attendance in schools, colleges. Even in banks this system can be used for withdrawing money with the face recognition technique. And a lot more by using large database in IT sectors we can use this type of system. In many aspects like to prevent retail crime, unlock phones , smarter advertising, find missing persons, protect law enforcement, Aid forensic investigations, diagnose diseases, recognize vips at sporting events, protect school from threats, casinos, facilities secure transaction , validate identity at ATMS and control access to sensitive areas.

REFERENCES

Journal Papers:

Dulal Chakraborty, Sanjit Kumar Saha, Md. Al-Amin Bhuiyan Face recognition using component analysis , International Journal of Computer Applications (0975 – 8887) *Volume 50 – No.10, July 2012*

Proceedings Papers:

[2]Er. Rosy Mishra(Asst. Professor in CSE) & Er. Plaban Dash (Lecturer in EEE) "'Feature Reduction and Robustclustering on Coloncancer data using principal component analysis " in the International Journalof RecentEngineering Research and Development (IJRERD) ,*ISSN: 2455-8761,Volume No. 02 - Issue No. 07, 2017.*

[3]Aleix M. Martinez, Member, IEEE, and Avinash C. Kak ," PCA versus LDA" IEEE Transcation On PatternAanlysis And Machine Intelligence, Vol. 23, NO. 2, Feburary 2001

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