DIGITAL IMAGE PROCESSING ON FACE RECOGNITION USING PCA

Sneha Gupta, Vipin Kumar Gupta ,Dr. O.S.Lamba

Department of Electronics and Communication Engineering

Suresh Gyan Vihar University, Jaipur, Raj, India

Abstract: This paper mainly targeted the edifice of face recognition system by using Principal Component Analysis (PCA). PCA is a statistical impend used for reducing the number of variables in face recognition. In PCA, every image in the training set is represent as a linear combination of weighted eigenvectors called eigenfaces. These eigenvectors are obtain from covariance matrix of a training image set. The weights are found out after selecting a set of most important Eigenfaces. Recognition is performed by analytical a test image onto the subspace spanned by the eigenfaces and then sorting is done by measuring least Euclidean distance. A number of experiments were done to calculate the performance of the face recognition system. In this thesis, we used a training database of Celebrities.

Keywords **- PCA, Eigenvalue, Eigenvector, Covariance, Euclidean distance, Eigenface.**

I. INTRODUCTION

This research paper mainly concentrates on Biometrics are a present method to recognize a person based on a physiological or behavioral attribute. The present features are fingerprints, handwriting, face recognition, hand geometry, iris, vein, voice and retinal scan. In the early years of the 21st century, we find ourselves persistently moving further away from the stipulation of physical human interface playing a major part of basic everyday tasks. Striding ever closer to a programmed society, we interact more habitually with mechanical agents, unsigned users and the electronic information sources of the World Wide Web, than with our human counterpart. It is therefore possibly sardonic that identity has become such an important issue in the 21st century. Face recognition has been related as the divine Grail of biometric recognition systems, due to a number of noteworthy advantages over other methods of identification. Face recognition has recently gained considerable attention, especially during the past few years. A human face divulges a great deal of information to an observer. It is used as a unique identity of a person. So face of a person uses for face recognition technology. This face recognition technology is the least encroaching and accelerated biometric technology. Unlike other biometric technologies like iris recognition and thumb impression, face recognition noticeably take pictures of people's faces as they enter a defined area. As human face is still not having a high degree of variability in its outer shell, that makes face detection a complex problem in computer vision.

II. ALGORITHM PROPOSED

In this we have proposed two algorithms. One is for loading of the database into the Matrix and another is meant for face recognition:

A. Algorithm for Loading the Database into the Matrix:-

Step 1: Zeros or Empty Vector is declared in accord with the size of image data.

Step 2: Reform the matrix into the vector with elements collected from the various subjects.

Step 3: Transform the matrix in unsigned 8 bit numbers.

Step 4: Provide each image a separate space into the dataset.

B. Algorithm for Face Recognition:-

Step 1: Mean and variance of the loaded dataset are made almost likeby mean and variance normalization technique. Mean and variance of one of the face images from the collections are treated as preferred mean and variance.

Step 2: Calculated mean is subtracted column by column from the matrix and now reshape the matrix into the vector whose features are collected column by column from the matrix.

Step 3: Correlation matrix is created by expending the collected vectors. Evaluation of Regression Coefficients is done by computing the Eigen vectors as of the parallel Eigen values of the correlation matrix.

Step 4: Eigen vectors calculated are reshaped into the matrix of the unique size. They are called Eigen faces.

Step 5: Normalization of orthogonal Eigen faces is completed by normalizing the vectors to create them orthonormal.

Step 6: Feature vectors are calculated known as Principal Components for each face image matrix as the interior product of Eigen basis vectors and the reshaped face image matrix.

Step 7: Mean vector is designed from the composed feature vectors of the same face is treated as the template assigned to that corresponding face of the person. This is repeated for other persons also. As a result one template is assigned to every person and they are kept in the database.

Step 8: To classify the unknown image as one among the four categories, template is calculated as the interior product of Eigen basis vectors (Eigen faces) with a reshaped normalized unknown image. The pattern thus attained is matched with the group of templates stored in the database using Euclidean distance.

Step 9: Template alike to the lowest Euclidean distance is selected and the person corresponding to that template is confirmed as the identified person.

We have followed certain steps throughout this research. All the steps are applied on the 400 images which we have taken for testing. In the flowchart presented in the figure

Below, we have presented the steps which we have used all through the research:

Flowchart of proposed technique:

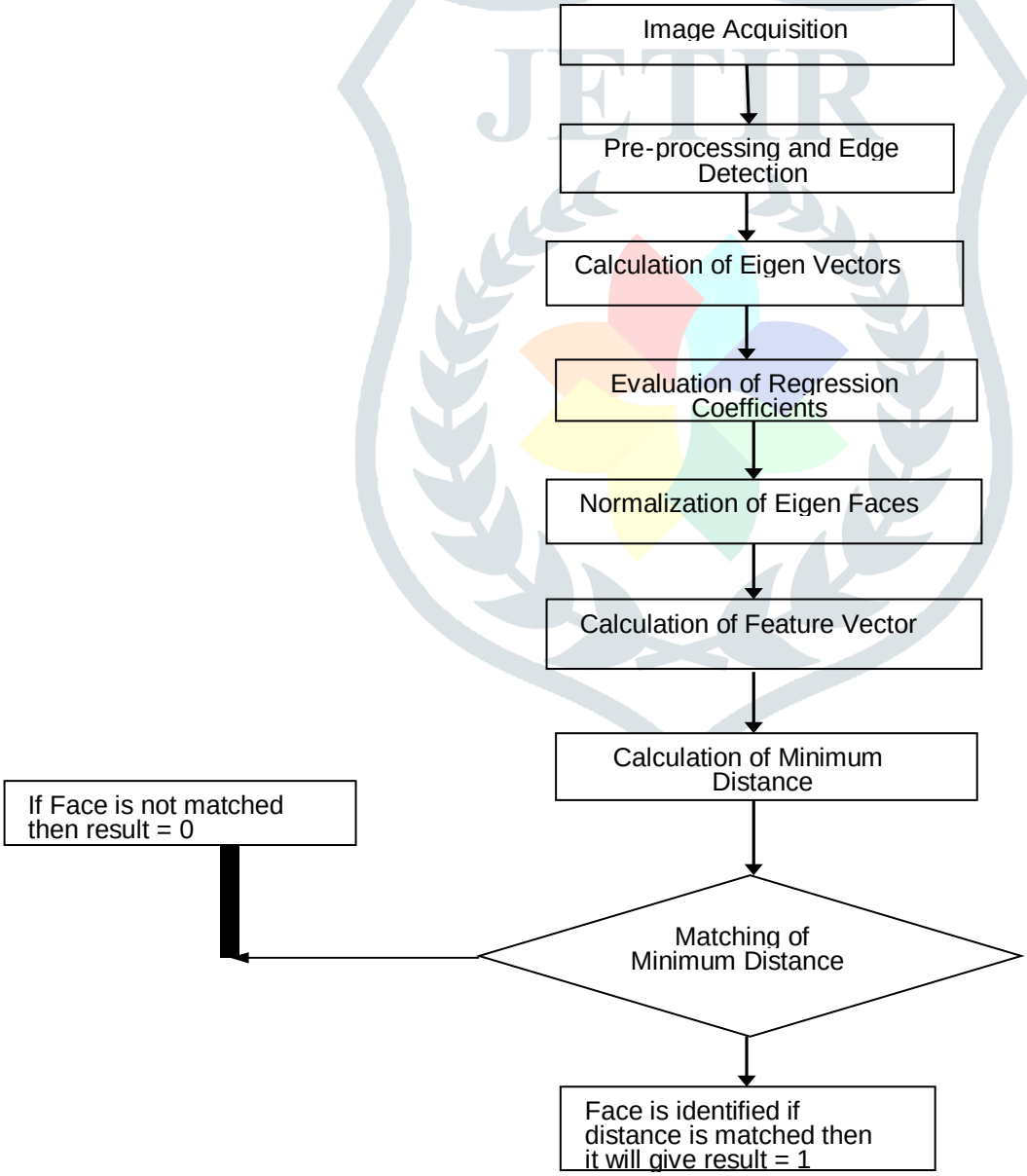

Figure 4.3 Flowchart showing representing the proposed work

The very first step is image acquisition, in this process image is overloaded into the database. The next step is pre-processing and edge detection, in which detection and removal of noise are performed. After pre-processing Eigen vectors are calculated. With the assistance of

these Eigen vectors regression factors are computed. Then in next step normalization of Eigen faces is achieved which are attained after the regression. In the last step feature vectors are detected by using PCA and then the minimum Euclidean distance of feature vectors is evaluated. On the basis of the minimum distance image is identified. When the image is correctly identified then it will give output 1 and the process is stopped. If the image is wrongly identified, then it will give output 0 and the process is stopped and all the steps are repeated.

RESULTS

When we start to run our codes in the command prompt window we achivedthe following results. The results we get are based on the images containing different facial expressions, pose, angle of rotation etc

Figure 1: Image shows recognition successes.

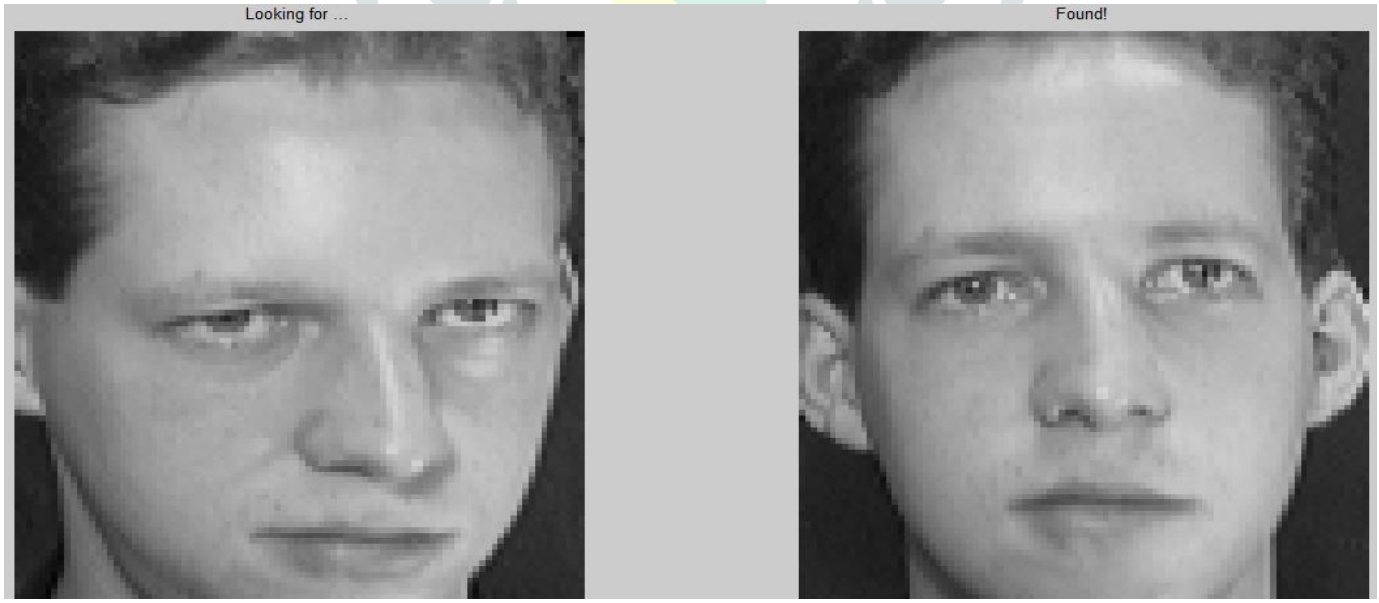

Figure 2: Result showing success when there is variation in the image taken

Figure 3: Results obtained when compared face is tilted and obtained resultant face is straight.

Figure 4: Recognition success when the face to be searched is tilted and obtained resultant face is somewhat rotated.

Figure 5: Recognition successes when there is a change in facial features.

Figure 6: results showing when there is a change in pose with expressions.

Figure 7 Results showing recognition success when there is a change in gender.

We have implemented testing on a set of 400 images by randomly dividing into five subsets. Subset 1 containing 20 images of two persons with 10 images person. The Subset 2 consist of 40 images with 10 images of 4 persons. Subset 3 contains 70 set of images of 7 different persons with 10 images per person. Subset 4 contains 120 images of 12 subjects and Subset 5 contains of 150 images. Testing time and Recognition rate of the experiments are shown in the Table (7) below:

Table: 1 Results obtained from the proposed algorithm after testing 400 images:

Subsets taken for Testing	Recognition Rate	Testing Time (in seconds)
Subset 1	100%	0.7419
Subset 2	97.14%	0.8615
Subset 3	84%	0.8126
Subset 4	95%	0.9132
Subset 5	88%	0.9868
Mean	**92.8%**	**0.8632**

As we can see in the table above the mean recognition rate obtained after applying the proposed approach is 92.8%. In our approach we estimate testing time as an extra factor. On an average the time required for testing the images is 8 to 9 seconds. With the help of MATLAB 7.10 we are able to find some histograms.

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