The International Journal of Engineering and Science (IJES)
|| Volume || 7 || Issue || 6 Ver. III || Pages || PP 06-10 || 2018 ||
ISSN (e): 2319 – 1813 ISSN (p): 23-19 – 1805

Implementation of an Algorithm for Face Recognition by Using Principal Component Analysis (Pca) In Matlab

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----------*ABSTRACT*----------
This paper was designed and implemented by using MATLAB (R2016a). This algorithm applied the eigenfaces system based on Principal Component Analysis (PCA) to ascertain the faces, in which a set of faces are stored in the data base which are used to compare other faces of different persons that may claim to ownership of account or other identities.
KEYWORDS: *Face recognition, Eigenfaces, Eigenvalues, Principal Component Analysis (PCA) and Holistic Matching*

Date of Submission: 11-06-2018 Date of acceptance: 26-06-2018

I. INTRODUCTION

The human face is a dynamic structure with characteristics that can easilychange with time. Face recognition is applied in many areas such as medical records, online banking, Passports, driver licenses , video surveillances , investigation , biometrics, access control, law enforcement, surveillance system,

security systems, identification of criminals, verification of credit cards and so on. Unfortunately, many face features make development of facial recognition systems hard. This problem is solved by the method called Principal Component Analysis (PCA).. Face recognition is one of the researches in pattern recognition & computer vision due to its diverse practical applications in the area of biometrics, Information security, access control, law enforcement, smart cards and surveillance system.

In order to design and develop a needful and appropriate face recognition system several factors are to be considered :

1. The overall speed of the system from detection to recognition should be acceptable.
2. The accuracy should be high

II. FACE RECOGNITION METHODS

Three methods were adopted,the methods are as follow:
1. Holistic Matching Methods
2. Feature-based (structural) Methods
3. Hybrid Methods

III. HOLISTIC MATCHING METHODS

In holistic matching method, the complete face region is captured with the aid of camera. One of the best examples of holistic methods areEigenfaces, Principal Component Analysis (PCA), Linear Discriminant Analysis and independent component analysis etc.

The first successful demonstration of machine recognition of faces was made by Turk and Pentlandin 1991 using eigenfaces. This approach covers face recognition as a two dimensional recognition problem. The flowchart in Figure 1 demonstrates the different stages in an Eigenface based recognition system.

The first step is to store a set of images into a database, these images are called as the training set. These will be used when we compare images and when we create the eigenfaces.

The second step ,Eigenfaces are created by extracting characteristic features from the faces. Eigenfaces will be resized in Order to have the same size. Eigenfaces can be extracted from the image data by using Principal Component Analysis (PCA).

When the features are extracted from the faces, each image will be represented as a vector of weights. The system is now ready to accept entering queries. The weight of the incoming unknown image is found and then compared to the weights of images already in the system. The identification of the input image is done by searching the image in the database whose weights are the similar to the weights of the input image. The image

in the database will be compared with the image of claimant,if it tallies ,access will be given to the claimant,if it does not match, access will be denied from the claimant.

IV. APPLICATIONS OF FACE RECOGNITION FACE RECOGNITION CAN BE APPLIED IN THE FOLLOWING AREAS:

 Security : access control to buildings, airports/seaports, ATM machines and border checkpoints, computer/ network security , email authentication etc.,

- Surveillance: A large number of CCTVs can be monitored to look for known criminals, drug offenders, etc. and authorities can be notified when one is located.
- General identity verification: Electoral registration, banking, electronic commerce, identifying newborns, national IDs, passports, drivers' licenses, employee IDs.
- Criminal justice Systems: Mug-shot/booking systems, post-event analysis, forensics.
- Image database investigations: Searching image databases of licensed drivers benefit recipients, missing children, immigrants and police bookings.
- "Smart Card" applications: Maintaining a database of facial images, the face-print can be stored in a smart card, bar code or magnetic stripe, authentication of which is performed by matching the live image and the stored template.

V. PCA APPROACH TO FACE RECOGNITION

More than the past 25 years, a number of face recognition techniques have been proposed, motivated by the increasing number of real-world applications and also by the interest in modeling human cognition. One of the most versatile approaches is derived from the statistical technique called Principal Component Analysis (PCA) adapted to face images. In the context of face detection and identification, the use of PCA was first proposed by Kirby and Sirovich. They showed that PCA is an optimal compression scheme that minimizes the mean squared error between the original images and their reconstructions for any given level of compression.. Turk &Pentland (1991) popularized the use of PCA for face recognition. PCA is based on the idea that face recognition can be accomplished with a small set of features that best approximates the set of known facial images. Application of PCA for face recognition proceeds by first performing PCA on a set of training images of known human faces. From this analysis, a set of principal components is obtained, and the projection of the test faces on these components is used in order to compute distances between test faces and the training faces. These distances, in turn, are used to make predictions about the test faces. Consider the D×K-dimensional face data matrix X, where D represents the number of pixels of the face images and K the total number of images under consideration. XXT is then the sample covariance matrix for the training images, and the principal components of the covariance matrix are computed by solving the following equation: RT (XXT)R Where A is the diagonal matrix of eigenvalues and R is the matrix of orthonormal eigenvectors. Geometrically, R is a rotation matrix that rotates the original coordinate system onto the eigenvectors, where the eigenvector associated with the largest eigenvalue is the axis of maximum variance; the eigenvector associated with the second largest eigenvalue is the orthogonal axis with the second maximum variance, etc. Typically, only the M eigenvectors associated with the M largest eigenvalues are used to define the subspace, where M is the desired subspace dimensionality.

Step 1 : Inserting a set of images into a database. These images are called as the training set.

 Step2 : Loading Database into matrix V

 Step 3 : Randomly pick an image from database

 Step 4 : Rest of images are used for training

 Step 5 : Randomly selected image is used to test algorithm

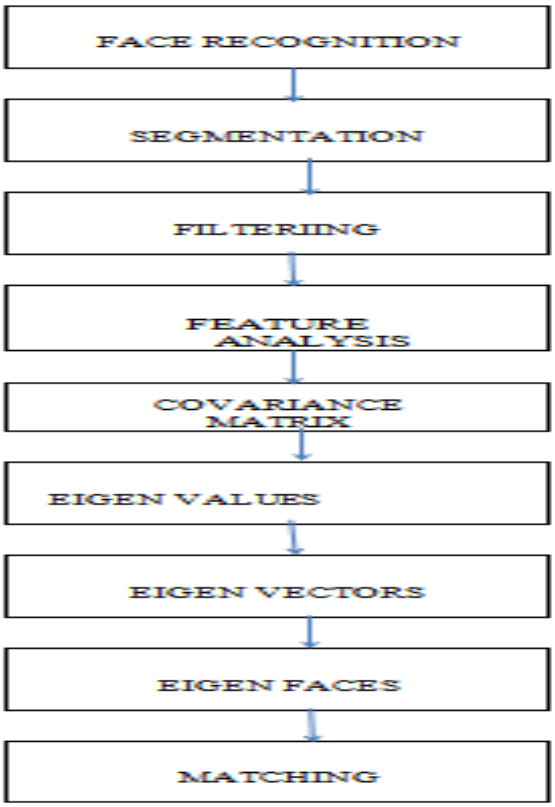
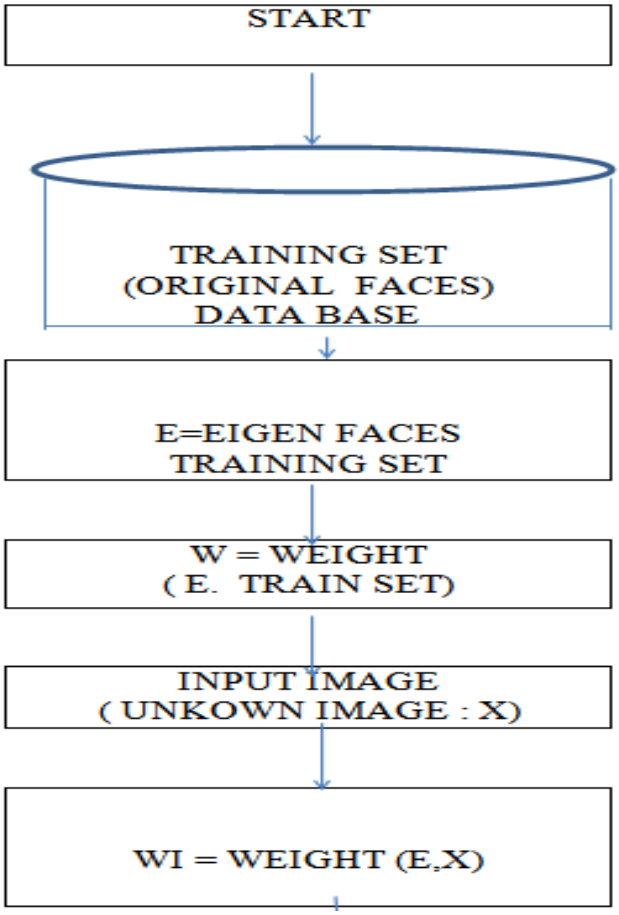


Fig. 1: Flow chart of PCA



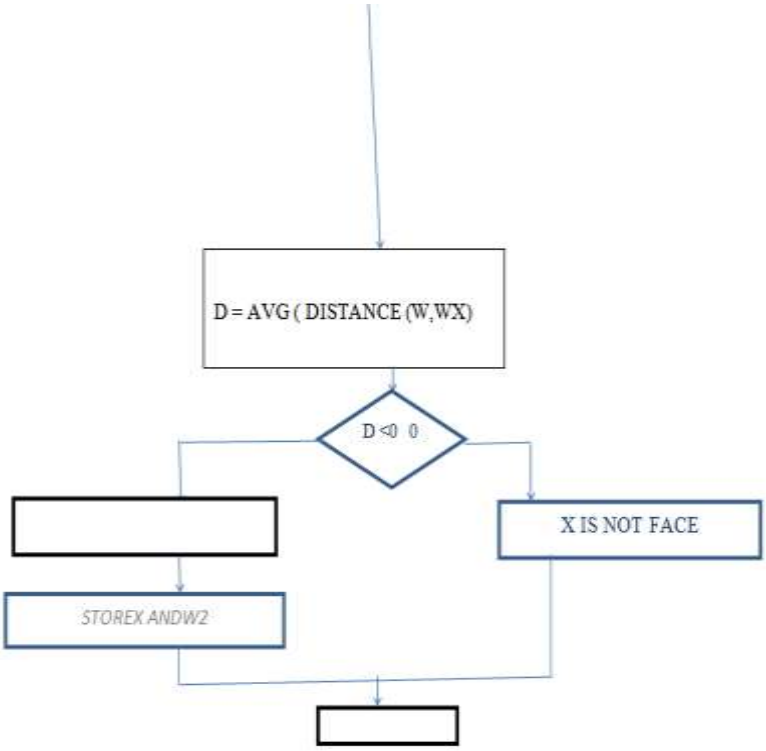


Fig1.1

VI. SOFTWARE DETAILS

This paper is completely based on MATLAB for face recognition. It is used in such a way that it is able to match the face from predefined database. and generate an output. MATLAB 2012a is utilized and its Image Acquisition and Image Processing toolbox are used.

VII.EXPERIMENTAL

Fig.1.1(a):pictures in the database(gotten by snapping different persons)

Fig.1.1(b):matched pictures(gotten by comparing claimant with that of database)

VIII. CONCLUSION

Face recognition method using Eigen faces is proposed. We used database of face images which contains 12 images of 12 different persons (each images per person). From the results, it can be concluded that, for recognition, it issufficient to take about 14% eigenfaces with the highest eigenvalues. It is also clear that the recognition rate increases with the number of training images per person. It is obvious that if the minimum distance between the test image and other images is zero, the test image entirely matches the image from the training base. If the distance is greater than zero but less than a certain threshold, it is a known person with other facial expression, otherwise it is an unknown person.

IX. RECOMMEENDATION

- There should be constant power supply to encourager next researcher
- Government should make enough fund available for other researchers
- This can be used in our ATMS in different banks to forestall money being made away by fraudsters

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Igwe,Agu Felix." Implementation of an Algorithm for Face Recognition by Using Principal Component Analysis (Pca) In Matlab." The International Journal of Engineering and Science (IJES) 7.6 (2018): 06-10