Volume 4, No. 8, August 2013
Journal of Global Research in Computer Science
ISSN-2229-371X
RESEARCH PAPER
Available Online at www.jgrcs.info

A ROBUST TECHNIQUE IMPLEMENTATION FOR FACIAL RECOGNITION UNDER EIGEN FEATURE EXTRACTION

Soninder Singh Garcha[1], Harpreet Kaur[2]
[1]Student of M.tech (CE) Regular
[2]Assistant Professor, Deptt. of Computer Engineering
University College of Engineering, Punjabi University Patiala
soninder1987@gmail.com

Abstract: This paper presents a Robust Technique implementation for facial recognition under Eigen feature extraction and further matching with testing image. In face recognition totally based on mathematical pattern recognition technique i.e extraction feature of eigen values for face of an image, training set is taken to train system with these images. During training are front postures of human being ion testing section various attacks are applied on image of human example noise, left poses, right poses, blurriness etc On these effects results are calculated to recognize the face on bases of eigen values and calculation is done on basis of distance and time and accuracy. System give a accurate value i.e 2.0 or 0.3 that what portion of the image are matched instead of YES or NO in traditional system(PCA,LDA etc.).

Keywords: Eigen value, Eigen vector, Principal component Analysis(PCA), LDA ,Euclidian distance

INTRODUCTION

This paper represents a step towards face recognition system under eigen feature extraction of 2-D images. In general, face recognition techniques can be divided into two groups based on the face representation they use:

a. Appearance-based, which uses holistic texture features and is applied to either whole-face or specific regions in a face image[5].
b. Feature-based, which uses geometric facial features (mouth, eyes, brows, cheeks etc)

Eigenface Approach:

Eigen Values and Eigen Vectors:

In linear algebra, the eigenvectors of a linear operator are non-zero vectors which, when operated on by the operator, result in a scalar multiple of them. The scalar is then called the eigenvalue (λ) [3]associated with the eigenvector(X). Eigen vector is a vector that is scaled by a linear transformation. It is a property of a matrix. When a matrix acts on it, only the vector magnitude is changed not the direction[5].

AX=λX (2.1)
Where Ais a Vector function.

Calculations of Eigen Values and Eigen Vectors:

By using (2.1), we have the equation,

(A-λI)X=0 (2.2)
Where I is the n x n Identity matrix. This is a homogeneous system of equations, and from fundamental linear algebra, we know that a nontrivial solution exists if and only if
det (A-λI)=0(2.3)

Where **det()** denotes determinant. When evaluated, becomes a polynomial of degree n. This is known as the characteristic equation of A, and the corresponding polynomial is the characteristic polynomial. The characteristic polynomial is of degree n. If A is n x n, then there are n solutions or n roots of the characteristic polynomial. Thus there are n eigenvalues of A satisfying the equation,

AXi=λXi (2.4)
Where i=1, 2, 3....n If the eigenvalues are all distinct, there are n associated linearly independent eigenvectors, whose directions are unique, which span an n dimensional Euclidean space[5,6].

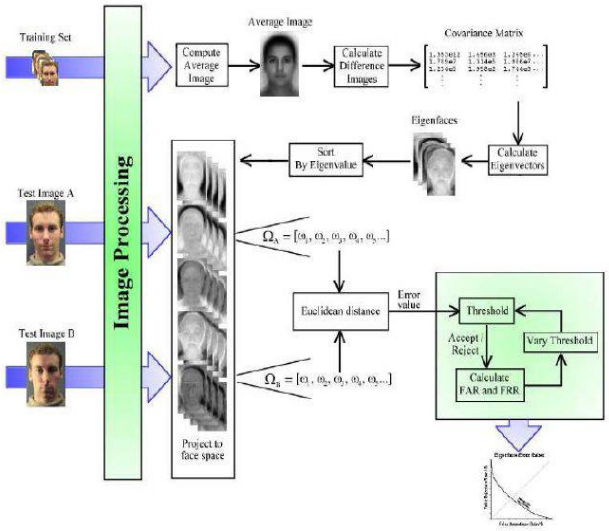

Figure 1. Face recognition system[4]

In Facial recognition system three major tasks which are explained below:

a. Loading the image
b. Training
c. Classification and Matching

Loading the Image:

The first step is to load the training images. You can obtain faces from a variety of publicly available Face databases. The main requirements are that the faces images must be[7]:

Greyscale images with a consistent resolution. If using colour images, convert them to greyscale first with rgb2gray. I used a resolution of 64 × 48 pixels[7].

Cropped to only show the face. If the images include background, the face recognition will not work properly, as the background will be incorporated into the classifier. I also usually try to avoid hair, since a persons hair style can change significantly (or they could wear a hat)[7][2].

Each image is converted into a column vector and then the images are loaded into a matrix of size *n* × *m*, where *n* is the number of pixels in each image and *m* is the total number of images[7].

Training:

Training the face detector requires the following steps

a. Calculate the mean of the input face images [7].
b. Subtract the mean from the input images to obtain the mean-shifted images[7].
c. Calculate the eigenvectors and eigenvalues of the mean-shifted images.
d. Order the eigenvectors by their corresponding eigenvalues, in decreasing order.
e. Retain only the eigenvectors with the largest eigenvalues .
f. Project the mean-shifted images into the eigenspace using the retained eigenvectors [7][2].

Classification and Matching:

Once the face images have been projected into the eigenspace, the similarity between any pair of face images can be calculated by finding the Euclidean distance $\|\mathbf{y}_1 - \mathbf{y}_2\|$ between their corresponding feature vectors $\mathbf{y}_1$ and $\mathbf{y}_2$; the smaller the distance between the feature vectors, the more similar the faces. We can define a simple similarity score $s(\mathbf{y}_1, \mathbf{y}_2)$ based on the inverse Euclidean distance[1][7]:

$$s(\mathbf{y}_1, \mathbf{y}_2) = \frac{1}{1+\|\mathbf{y}_1 - \mathbf{y}_2\|} \in [0, 1]$$

To perform face recognition, the similarity score is calculated between an input face image and each of the training images. The matched face is the one with the highest similarity, and the magnitude of the similarity score indicates the confidence of the match (with a unit value indicating an exact match)[2][7].

Given an input image input_image with the same dimensions image_dims as your training images, the following code will calculate the similarity score to each training image and display the best match [7]

Below is an example of a true positive match that was found on my training set with a score of 0.4425:

Figure 2. Matching image with testing image

To detect cases where no matching face exists in the training set, you can set a minimum threshold for the similarity score and ignore any matches below this score[7].

METHODOLOGIES

a. Study previous work related to Face recognition.
b. Acquire an initial set of face images (the training set)[4].
c. Calculate the eigenfaces from the training set, keeping the M best images and there corresponding eigenvalues to make up the face space [4].

In order to calculate the eigenfaces I followed the method I have outlined below:

a) Calculate the average image of the training set(ψ):

b) Find the difference of each face form average face(Φ):
c) Calculate the matrix L and calculate its eigen vectors () *uL[4].*

And can then from the set of weights for each image (Ω) .

d. Testing and matching an image and then verification with database then produced output.

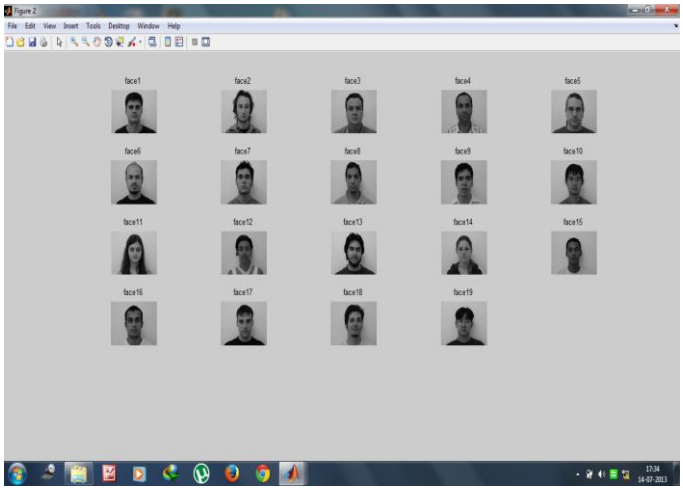

Figure 3. Convariance matrix of trainig images

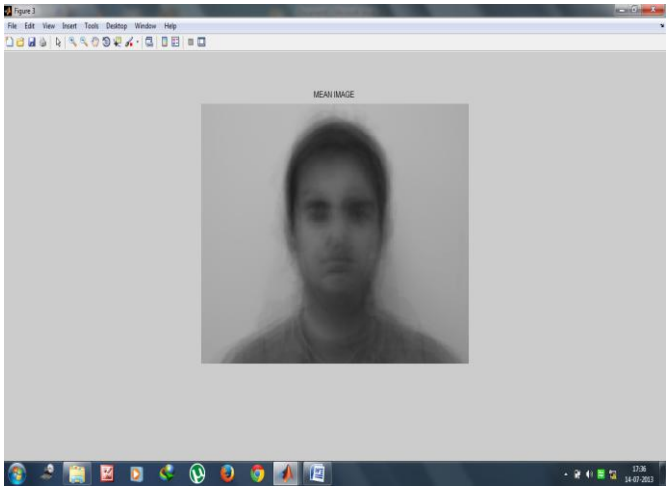

Figure 4. Avg mean image

APPLICATIONS OF FACE RECOGNITION (EIGEN FEATURE EXTRACTION) SYSTEM

Access Control:

Face verification, matching a face against a single enrolled exemplar, is well within the capabilities of current Personal Computer hardware. Since PC cameras have become widespread, their use for face-based PC logon has become feasible, though take-up seems to be very limited [6].

Identification Systems:

This is an identification task, where any new applicant being enrolled must be compared against the entire database of previously enrolled claimants, to ensure that they are not claiming under more than one identity [1]. Face recognition is the secondary biometric added to an existing fingerprint identification system. Several have also instituted face recognition for ensuring that people do not obtain multiple driving licenses[6].

Surveillance:

The application domain where most interest in face recognition is being shown is probably surveillance. Video is the medium of choice for surveillance because of the richness and type of information that it contains and naturally, for applications that require identification, face recognition is the best biometric for video data. Though gait or lip motion recognition have some potential [4]. Face recognition can be applied without the subject's active participation, and indeed without the subject's knowledge. Automated face recognition can be applied 'live' to search for a watch-list of 'interesting' people, or after the fact using surveillance footage of a crime to search through a database of suspects[6].

CONCLUSION AND FUTURE SCOPE

Face recognition is a technology just reaching at peak point for it to experience a rapid growth in its practical applications [6]. There are many techniques such as PCA, LDA but Eigen Feature extraction for face recognition applied to expanding the accuracy, capabilities and robustness of this biometric domain, Verification systems for physical and electronic access security are available today, but the future holds the promise and the threat of passive customization and automated surveillance systems enabled by face recognition.

ACKNOWLEDGMENT

I am thankful to Dr. Amardeep Singh (Associate Professor & Head of Department), Er Harpreet kaur(Assistant professor) who provided us with all amenities. We pay our regard for being given the much needed expert guidance. We also thank my wife and all my friends at college and teachers who provided us their much needed help.

REFERENCES

[1]. Stan Z. Li and Anil K. Jain, Handbook of Face Recognition, Springer, 2005.

[2]. W. Zhao, R. Chellappa, P.J. Phillips and A. Rosenfeld "Face Recognition: A Literature Survey," ACM Computing Surveys, vol. 35, no. 4, pp 399-458, Dec 2003.

[3]. H.Wang and N. Ahuja, "Facial expression decomposition," in Proc.IEEE Int. Conf. Computer Vision, 2003, vol. 2, pp. 958–965.

[4]. Adam Schreiner, "Image Processing Techniques for Face Recognition". In university Wiscosin Madison ECE 533 project ,2006.

[5]. Vinay Hiremath and Ashwini Mayakar , "Face Recognition Eigenface" in IRCSE ,2009.

[6]. Andrew W. Senior and Ruud M. Bolle, "Face Recognition And its Applications, in Achievement and Challenges in fingerprint Recognition.

[7]. "Eigenfaces Face Recognition (MATLAB)" under Article in Deadbeef the rat of technocrat, Dec 2010.

Short Bio Data for the Author

Soninder Singh Garcha received his B-Tech in Computer Science Department from Baba Banda Singh Bahadur Engineering College, Fatehgarh Sahib(Pb) in 2009. Currently he is pursuing M-Tech in CSE From Punjabi university, Patiala, his current research interest include software reuse concepts and digital image & signal processing.