A Fascinating Territory Approaching Edge Detection using feasibility of Eigen Face to Identify an Individual

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***Abstract*- Face recognition technique is one of the most fascinating territories of computer vision. The aspiration of this manuscript is to compare an image with other several images which has been cached in a database and can identify it. The methodology of this manuscript is to calculate the Eigen faces and then identify a person from these generated Eigen faces. This face detection system recognizes a face in gray scales, while the images which are stashed in the database are in RGB. To identify those images one should convert it into gray scale images. Furthermore to obtain the edges of face, gray scale images converted into binary images. Eigen faces has been generated by using these edges. For identification one can compare an image with calculated Eigen faces and can recognize the individual face.**

Keywords- Recognition; eigenfaces; edge detection; identification; database.

I. INTRODUCTION TO FACE IDENTIFICATION

This paper is demonstrating the face recognition system to identify a person. K.H. Lin et. al. elaborate that there are miscellaneous facial points which accumulate different portion, paradigm: eyes, mouth, nose etc [25]. The agenda of this manuscript is to comprehend the complex gesticulation of human face and distinguish the different identity with high precision.

Face recognition system disseminate in two fragment, feature based approach and holistic approach. M. Turk et. al proposed a system in which it used the eigenfaces for feature based approach[24]. Detection and characterization of feature and their geometrical relationship comes in feature based approach. It fetches nose, eyes and mouth etc. The holistic approach admit the encoding the face and this result code treating in high dimensional space. W. Zhao et. al and Minglun Gong et. al narrated a system in which they used these approaches [22][23] . The simple approach of this manuscript is that first take the mug shots and look at the intensity value which is called appearance. After capturing the image of a person there are several views of each person are concerted in the data base. Le Ha Xuan et. al. explain a system in which Eigenface technique was utilize to normalize faces in the database[8]. Using these different views, it generates some model and when it recognize a person then give an unknown image and it can make the vector out of it and find out the best match of the person. This is very intuitive and very simple method. If it is 'similar' then the difference will be small and match will be maximum and if it is 'different' than difference will be large and match will be small.so it will choose the closest one. Typical image is pretty large like 512x512 images, if it makes the vector out of that it will be 250,000 dimensional vectors. This is very large vector; it will match element by element from this vector and find out the people. In order to solve this problem it reduces the dimensionality. It going to use notion of Eigen vector again if this manuscript exhort about Eigen vector it's uses in different message and here it will use in face recognition. So, that method which will detract the dimension of vector calls the PCA. Wei-Shi Zhenget et.al illuminate system in they used the PCA for reducing the dimension of vector [12]. PCA will kind of given basis that it can represent any vector in terms of those

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Eigen vectors. Manzoor Ahmad Lone et. all used four different algorithm for recognition the face. They used the PCA for reduce the eigen vector [1]. And Heng Fui Liau et. all proposed a method in which they used the PCA to extract the feature[5]. The main point here is there can be few most significant Eigen vectors which it is use as compare to be need known that very huge dimensional space like 250,000 dimensional space.

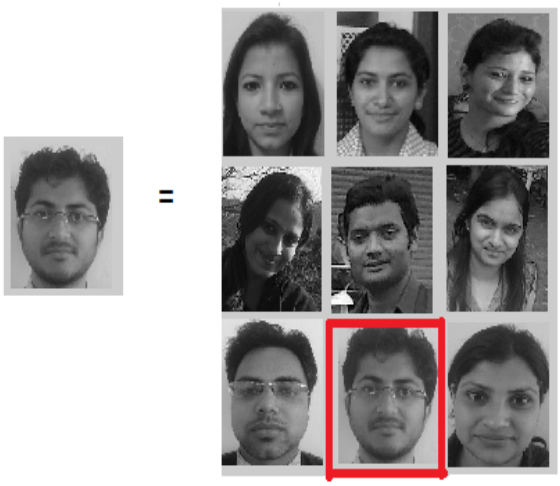

Figure 1. Face Recognition Procedure

II. Related Work

Manzoor Ahmad Lone et. al used four different algorithm for recognition the face. In this model it has to compare with individual person. So it is a time consuming process [1]. Yoshihiko Nankaku et. al proposed SL-HMMs for modeling multi-dimensional data, e.g, images, image sequences, 3-D objects. The efficiency of two dimensional image is very high and in this paper it uses he 3D data. Its efficiency of images is not so good[10]. Soumitra Kar et. al described the multi-algorithmic face recognition system in which they used multi biometric technique. Which is very costly[11]. Dr. Hassan Fahmy Hashem elaborate Comparison between Eigenface and Wavelet Technique as Methods of Face Recognition in which they compare two method, that's why its accuracy is average not peffact[13]. Takeshi Shakunaga Kazuma Shigenari, Soumitra Kar, Dilip G. Joshi used the method principal component array for reducing the dimension but it is used only in gray scale not in RGB images[11,20,21]. PCA reduces the dimension by means of basic data compression method [18] In PCA method the images are projected on the value of facial which is called eigenspace [7] and [13]. More results of face detection against skin color-like backgrounds this result was also compared with those of Huang et al. [3] and Hu et al. [4].

III. METHODOLOGY

First of all take all gray level in face image and make the long vector out of this, will call 'u'. This is look like given below

$$u = (I(1,1),..I(1,N),I(2,1),..I(2,N),I(M,1),..I(M,N))^T$$

In this equation I stand for image. I(1,1) is first row and first column and thus I(M,N) is M rows and N column. So this will be a MxN dimensional vector. So that its u vector. It will take image and make a vector out of it.

It is going to assume that for each person It has the n views or samples and there are p person. P can any number. From these vectors it can make a matrix and that will look like this

$$A = [u_1^1,\ldots u_n^1, u_1^2,\ldots u_n^2,\ldots..u_1^p,\ldots..,u_n^p]$$

$u_1^1$is the first person first view and u_1^2 is second person first view and so on. It put the image in column vector and dimensions of its vector are MxN.

Let the persons are 'p' then there are pxn column in this matrix, and each column is 512x512 which is 250,000 dimensional vector, which is very large vector.

From the correlation matrix L(MNxMN)

$$L = AA^T$$

Compute eigen vector, Φ_1, Φ_2, Φ_3,...Φ_n, of L which from the bases for whole face space

Each face, u, can be represented as a linear combination of eigenvectors.

$$u = \sum_{i=1}^{n} a_i \Phi_i$$

Eigenvector for symmetric matrix are orthonormal

$$\Phi_i^T \Phi_j = \begin{pmatrix} 1 & If\ i=j \\ 0 & If\ i \neq j \end{pmatrix}$$

$$u_x^T \Phi_i = (\sum_{i=1}^{n} a_i \Phi_i)^T \cdot \Phi_i$$

$$= (a_1 \Phi_1^T + a_2 \Phi_2^T ..+ a_i \Phi_i^T + \ldots + a_n \Phi_n^T) \cdot \Phi_i$$

$$u_x^T \Phi_i = (a_1 \Phi_1^T \cdot \Phi_i + a_2 \Phi_2^T \cdot \Phi_i + \ldots a_i \Phi_i^T \cdot \Phi_i + a_n \Phi_n^T \cdot \Phi_i)$$

$$u_x^T \Phi_i = a_i$$

Therefore $a_i = u_x^T \Phi_i$

The eigenvectors of this matrix can be found through the following formula:

$$u = \sum_{i=1}^{n} a_i \Phi_i$$

L is very large matrix. Computing eigen vector of large matrix is time consuming. There compute eigen vector of smaller matrix which is called 'C'. With the help of C it make the L

$$C = A^T A$$

Let α_i eigenvector of C then $A\alpha_i$ is the eigenvector of L

$$C\alpha_i = \lambda_i \alpha_i$$
$$A^T A\alpha_i = \lambda_i \alpha_i$$

Multiply A on both sides

$$AA^T (A\alpha_i) = \lambda_i (A\alpha_i)$$

(AA^T is L matrix)

$$L(A\alpha_i)) = \lambda_i (A\alpha_i)$$

PROJECTING FACES INTO FACE-SPACE-

After creating eigenfaces, then it visualize a face image into facespace for analyze or recognize it. It can be through with by following formula.

$$\mathbf{w} = \mathbf{U}^T(\mathbf{A} - \mathbf{Ø})$$

The vector of weights is found by multiplying the transpose of the matrix $\mathbf{U}^T$

By a vector that is found by subtracting the average face image **Ø**, from a sample or test image $\mathbf{A_n}$.

The weights form a vector

$$W^T = [w1,w2\ldots..wm']$$

that delineates the contribution of each eigenface in representing the input face image. This vector is used in a standard pattern recognition algorithm. The easiest methodology for traversing of an input face image is to get the face class k that understate the Euclidean distance

$$e^2_k = \|(W - W_k)\|^2$$

Where W_k is a vector describing the k^{th} face class.

IV. EXPERIMENT RESULTS

This experiment needs some database containing some images of individual person in different facial expression. The image size should be same. Here the image being cropped and resize 200x180 pixels

Operation and Result-

- Calculate Eigenfaces
- Input Image for Recognition
- Delete Database
- To quit the program
- To quit without exiting matlab

Calculate Eigenfaces-

Convert RGB into Gray- For finding the result of this operation first calculate the eigenfaces. For calculating the eigenfaces first take the sample of images. Here it is using 22 samples and convert it into gray scale. Because the intensity of gray scale is very high comparatively.

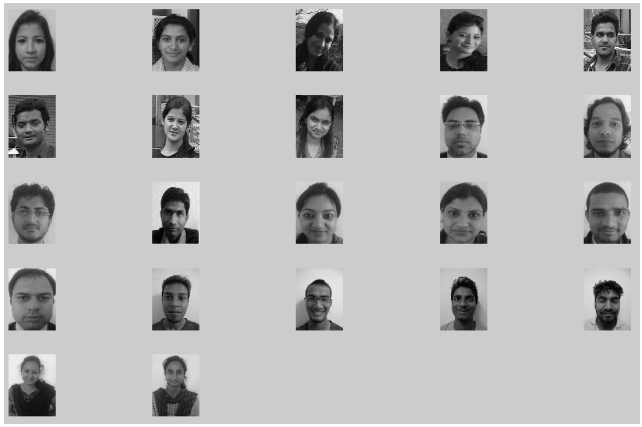

Figure 2. Converting RGB Images into Gray Scale

Convert Gray Scale into Binary Image- After getting the gray images these images convert into binary image, which will be in the form of 0 and 1. It is use for finding the edges as shown in fig: .

Figure 3. Convert Gray Images into Binary Image

Calculate Eigenfaces- After converting gray image into binary image calculate the eigenfaces of 22 sample images. It calculates the 22 sample images and gets the 11 eigenfaces as shown in fig

Figure 4. Calculate Eigenfaces

Input Image for Recognition- this is the second process of the experiment. First take an input image from the database and detect its every detail by this experiment.

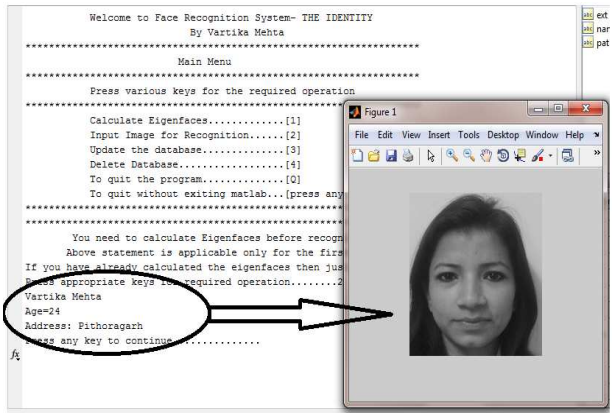

Figure 5. Detecting the face

Image should be in database. If it take an image which is not in database the result shows that "No match found" as shown in given below.

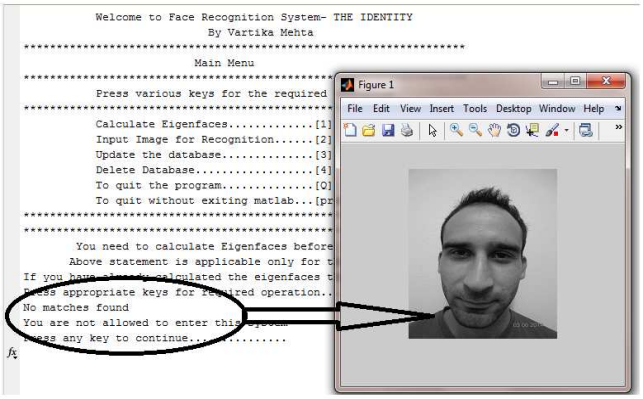

Figure 6. Detecting the image which is not in database

The roll of database is very important in this paper. It can detect the person who is not present in database even it also can detect the image which is not of face. Figure shows that if this model takes an image which is not even a face then it will show a message in command window. The message will be "Image is not even a face". Figure 7

Figure 7. Detecting the image which is not a face

This technique is very successful in computer vision for identification of person.

The next operation is deleting the database, If the person wants to delete the database then command window shows the message "Do you really want to delete the whole database. Press Y for yes and N for no". For deleting the database press Y then the database will delete.

To quite the program it need to press Q. then it will show the message "Are you sure you want to quit Press Y for yes or any other key for No" and the matlab software will be

close. If it want to quite the program without exiting the matlab the it has to press any key.

V. CONCLUSION

Face Recognition method is augmenting in every steppe. This manuscript demonstrate the ability to recognize the face in gray scale. Face recognition using eigenfaces has good accuracy for detecting the face. PCA reduce the dimension of the data, in view of this it can detect the person effortlessly. This is very fast, robust and accurate method. It can calculate the eigenface then detect the face very accurately. The algorithm which is used in this method is very simple and easy to understand. In comparison to other technique it is very simple and time saving process. Using this technique for face recognition security has increased in every field.

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