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HIGH ACCURACY FACE REORGANIZATION BY PCA - SVD

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ABSTRACT

Face Detection or Reorganization is a Part of biomedical technology which is working for the many applications like Banking, Human-Computer interaction, Implementation Security, Retrieval of Data Base, etc. Base paper is using Principal Component Analysis (PCA) for Face Detection. PCA is a methodology for the Face Detection which is using for reducing the variable in the Face Reorganization. The image in the training set can be represented as linear combination of Eigen Vector which is called by "Eigen Faces". From the Covariance Matrix, we can get the Eigen Vectors of training Image set called the basic function. For Face Reorganization in PCA method, the test image is projected onto subspace with the help of Eigen Faces and the for Face Reorganization. Distance will measure such as Euclidean distance. All the test images will check by this method for Face Reorganization. In this Research , we are improving the Accuracy of the Face reorganization system by use PCA+SVD .We are taking the training data sets of different faces for recognize the face . From the result session, we can see the Accuracy of face detection . Accuracy is getting increase as we apply PCA+SVD.

KEYWORDS: Face Recognition, Principle Component Analysis (PCA), Eigenface, Covariance matrix, Face database.

INTRODUCTION

A facial recognition system is computer software developed particularly for the recognition & verification of a person from a digitized picture from source of video. One method to do this is by making comparison in choosing facial attributes from an image & facial database. It is generally implemented in security systems & can be put in contrast to other relative biometrics systems like fingerprints or iris identification systems [1].

RELATED WORK

From Year of 2000, a rapid growth in the field of hardware & software technology tends to develop fancy & friendly user interfaces & even more possible than that. As an illustration, for some of the patients that are unable to type or use a mouse, the eve gaze systems are developed for them. In such systems user is able to control the functions of mouse by looking at picture or word as shown on the screen. In the year 2007, Sony launched its first camera for users named as Cyber-shot DSC T20 having a function of smile shutter. This feature is able to recognize three faces of humans to maximum in the picture & automatically click the picture is it detects a smile. Several users complained about this feature to be lacking in terms of accuracy & it is found that the Sony smile shutter can detect only big smiles but not slight smile. Also, it will be triggered if teeth of the individuals appear. So, we suggest a better smile detecting system that is more accurate & can be used on a personal computer & web-cam.

The issues linked to detection of smile are covered by face expression recognition. There are a lot of academic researchers conducted over facial expression recognition, like [23] & [25], but not deep research is done over detection of smile. Though, rate of detection & algorithm of Sony' smile shutter are not provided. A smile measuring software is recently release by sensing Component Company named Omron [22]. It is able to identify the faces or one or more than one person & allocate a smile factor of 0%-100%. Omron makes use of a 3-D face mapping technique & acclaim that it has detection rate of more than 90%. Though, it is not available & we are unable to test its performance. So, we will be testing our program with Sony T300 & exlain that we have better performance for recognizing slight smiles & minimize rate of false alarm on grimace expressions.

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PCA ALGORITHM

The PCA (Principal component analysis) is the popular methods for to reduce face recognition variables. In the PCA, the faces are presented as the linear combination of the weighted eigen-vectors called as Eigen faces [2][3][4]; Such eigenvectors are gained from matrix covariance a training image set called as the basis function. The Eigen faces number which obtained may be equal to image numbers in a training set. The eigen faces take the advantage in between the pixels that among the images in the dataset employing the covariance matrix. Such Eigen vectors are characterized the new face space where the images get represented. To alter the required documentation, let us introduce the following symbol. Assume that the training image set-I consist of the N images each one having the size a×b pixels. Hence, by using the conventional method of row appending converts every image into the column vector of dimension a×b.

$I = \{ i_1, i_2, \ldots\ldots, i_n \}$ .....(1)

The covariance matrix '*c'* of the training image set is considered by using equation (3.2)

$$c = \frac{1}{N} a_{n=1}^{N} (i_n - \bar{i})^T (i_n - \bar{i}) \quad \ldots (2)$$

The Eigenvectors finds that '*U'* have an appearance of a face, they're called the Eigen faces. Generally, they called as the Ghost Images, due to their weird appearance. And after a face space has constructed, the linear combination of a feature vector is formed by the eigenvectors of a covariance matrix. Project the face space image with the following equation.

$$P_n = U^T * (i_n - \bar{i}) \quad \ldots\ldots (3)$$

Here, P_n, n= 1, 2,….., N are weights of a vector that associated with eigenvectors in '*c.'* One can try different things with eigenvectors quantity to process the weights, for the most part, just a couple of amount give adequate data to sufficiently representing the image to a face space. For an acknowledgment of unknown face or the test picture, standardize it by subtracting from the mean vector of entire images in a set. At that point by utilizing condition (4) project a standardized test image as appeared in the accompanying condition,

$$T = U^{T\prime} D \quad \ldots\ldots (4)$$

Where, D - normalized test image.

And after a feature vector/weight vector test image has discovered, the next-step is to characterize it. For the task of classification, we could utilize Euclidean distance classifier.

$e = min||T - P_n||$ .....(5)

N=1,2,…..N. On the off chance that the separation is little i.e. small distance, we can say that the images are comparable, and we are able to choose a most comparative image in a database.

PROBLEM STATEMENT

The face recognition is the biometric technology having the vast range of the potential applications likes database retrieval, virtual reality, human-computer interaction, information security, banking, and access control, etc. Hence, by using the PCA (Principal Component Analysis) a base paper addresses the face recognition system building. The recognition is functioned by the new image projection (test image) on a sub-space that spanned by eigen faces and then the classification is done by the methods of distance measure like the Euclidean distance. Many experiments have been done for performance evaluation a face recognition system. In a base paper, the PCA algorithm is given that based on face detection. And for particular research, we find an Accuracy issue. The Face Detection Accuracy may be further increased by suggested methodology.

PROPOSED METHODOLOGY

The PCA (Principal Component Analysis) is the statistical method that used for dimension recognition and reduction, & the broadly used for a facial feature of recognition and extraction. The PCA is known as the ESP (Eigen Space Projection) that has depended on linear projection an image space in order to low Dimension feature space which is known as the Eigen space. Many PCA -based systems of face recognition have been developed in the last decade. However, an existing faces recognition systems (PCA -based) are hard measure due to computational memory and cost needing load. The 2- D (Two Dimensional) facial image is represented as the 1-D (dimensional) vector by concatenating every column or row into the long thin vector. Let's assume, and we have N Size M vectors (= rows of the image £ columns of the image) illustrating a sampled images set. Pj's represent the pixel Values.

$x_i = [\, p1\, , PN\,]^T ; i = 1, \ldots, M$ ...(6)

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And by subtracting a mean image from every image vector, the images become the mean centered. Let, 'm' stand for a mean image.

$$m = \frac{1}{M}\sum_{i=1}^{M} x_i \qquad \ldots.(7)$$

And suppose w_i be the defined as the mean centered image

$$w_i = x_i - m \qquad \ldots.(8)$$

The aim is to find the set of e_i's that have the greatest possible Projection on to every of w_i's. The singular value de-composition is the linear algebra output. And SVD in the digital applications gives robust/strong technique large image storage as smaller one, as well more manageable square ones. The matrix A singular value de-composition of matrix m x n is also given in a form,

$$A = U \sum V T \qquad \ldots.(9)$$

Where, the U = m x n orthogonal matrix; size m x n;
V = n x n orthogonal matrix,
and Σ = m x n matrix consisting a singular value of the A along its most important diagonal.

The SVD (Singular value decomposition) is a suitable rectangular matrix factorization which has been used largely in the data retrieval for minimizing document dimension vector space. The de-composition may be defined as the follows. Given is the generic rectangular n×m matrix- A, its SVD is:

$A = U \sum V^T$ .... *(10)*
Where U = n × r matrix;
V^T = r × m matrix
And, Σ = r x r diagonal matrix.

The two- matrices U & V are unitary, that is., $U^T U = I$ & $V^T V = I$. The diagonal components of Σ are of singular values like $\delta_1 > \delta_2 > \delta_r > 0$.

Where r = rank of matrix A.

The SVD utilize a linear combination of columns and rows of A for decomposition.The initial trivial method of using SVD as the unsupervised quality reduction is following. The given 'E' as the training set for examples it is represented in the feature-space of the n- features, We may notice it as the matrix, that is, an examples sequence $E = (e_1 \ldots e_m)$. With the SVD, the n×m matrix E may factorize as the $E = U \Sigma V^T$. The factorization implies that we are able to concentrate the learning problem on the brand new space by using the given transformation by the U matrix. It is a new space that is illustrated by a matrix:

$E' = U^T E = \Sigma V^T$ ..... *(11)*
Where the every example is observed with the 'r' new features. Every new feature is gained as the linear combination of original features, that is, every feature vector e_l may be seen as the new feature vector $e_l' = U^T e_l$. When the end feature space is vast, whereas the trailing set cardinality is small, the is, n>>m, the SVD application results in the original feature reduction space as a rank 'r' of a matrix E is 'r' < min (n, m).

The most interesting technique of utilizing SVD is like the selection of un-supervised feature to exploit an approximated computation, that is:

$A \approx A_k = U_{m*k} \Sigma_{k*k} V^T_{k*n}$ .....*(12)*
Where, 'k' = Smaller than a rank r.
The essential step in the direction of denoising is to obtain SVD. In order to get the SVD of an image 'A,' of the size [MxN], A is re-shaped to obtain the matrix A1 of a size [4 x MN/4]. The SVD of A1 got as,

[U S]= SVD (A1) ....*(13)*

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RESULTS

For implement the Face Reorganization , we give the input image that , perform from the training set and then implement into normalize Training set. Figure 1. is showing the Normalize Training set for the given input .

Figure 1 :- Generate Training Set

Normalize Training set is showing in the figure 2 . Figure 2 is showing the generated normalize training set for given input .

Figure 3 :- Normalize Training Set

Figure 4 :- PCA Based Face Reorganization

igure 4 is showing the PCA based face Reorganization. As we can see , we give the input sample image and at the output we get the matched images from the large image data set .

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RESULTS

We are showing the Results of the PCA+SVD based face Reorganization. As we can see , we give the input sample image and at the output we get the matched images from the large image data set by use PCA+SVD .

Figure 5 :- Face Reorganization by PCA +SVD

Figure 6 is showing the output of the Accuracy . As we can see from the figure 6 the accuracy of the PCA+SVD is high as compare to PCA . Green color graph is showing the Accuracy for the PCA while Black color is showing the accuracy for the PCA+SVD based face reorganization.

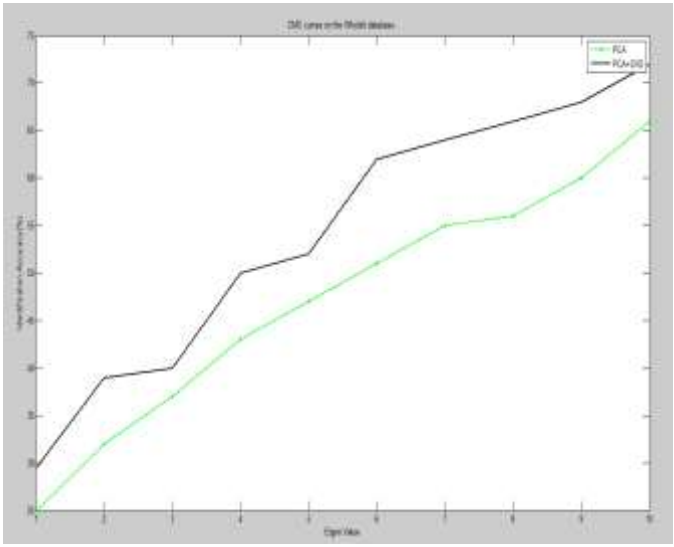

Figure 6 :- Accuracy of Face Recognition

CONCLUSION & FUTURE SCOPE

In this paper, we are improving the accuracy of the face reorganization system . In the previous paper , they was using PCA algorithm for face detection . In this thesis, we are using PCA +SVD based algorithm so that accuracy can get increase .As we can see from the results session , the Accuracy of PCA+SVD get increase up to 30% as compare to PCA.

In the future ,we can work for the project limitations. According to our first limitation , in the future we can work for the Face expression also . In the present time we are working only for the Face Recognition but face expression recognition system also can be introduce along with Face recognition. In the results session ,we can also introduce

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some more parameters like PSNR and MSE . We can also introduce the hardware for detect the face and also able to increase the data base .

REFERENCES

[1] Priyanka Dhoke1, M.P. Parsai2," A Matlab Based Face Recognition Using Pca With Back Propagation Neural Network" International Journal Of Innovative Research In Computer And Communication Engineering Vol. 2, Issue 8, August 2014.
[2] V. Balamurugan, Mukundhan Srinivasan, Vijayanarayanan.A," A New Face Recognition Technique Using Gabor Wavelet Transform With Back Propagation Neural Network ", International Journal Of Computer Applications (0975 – 8887) Volume 49– No.3, July 2012
[3] Sachin Shende & Rahila Patel ," Efficient Face Detection Using Pca And Ann Techniques ", Issn (Print) : 2319 – 2526, Volume-2, Issue-5, 2013.
[4] Navneet Jindal 1, Vikas Kumar ,"Enhanced Face Recognition Algorithm Using Pca With Artificial Neural Networks ", International Journal Of Advanced Research In Computer Science And Software Engineering Volume 3, Issue 6, June 2013.
[5] Vijayalaxmi , P.Sudhakara Rao And S Sreehari "Neural Network Approach For Eye Detection" .2012
[6] Omaima N. A. Al-Allaf "Review Of Face Detection Systems Based Artificial Neural Networks Algorithms" February 2014
[7] Aruna Bhadu, Rajbala Tokas, Dr. Vijay Kumar " Facial Expression Recognition Using Dct, Gabor And Wavelet Feature Extraction Techniques" July 2012
[8] Dinesh Kumar, Rajni " Face Recognition Based On Pca Algorithm Using Simulink In Matlab"July 2014 .
[9] Poonam Dhankhar, Neha Sahu "Edge Based Human Face Detection Using Matlab" Feb 2014 .
[10] Ms. Jaishree Tawaniya, Ms. Rashmi Singh, Ms. Neha Sharma, Mr. Jitendra Patidar "Image–Based Face Detection And Recognition Using Matlab" May 2014 .
[11] Jawad Nagi, Syed Khaleel Ahmed Farrukh Nagi "A Matlab Based Face Recognition System Using Image Processing And Neural Networks"2008 .
[12] Nisha Soni, Garima Mathur, Mahendra Kumar" A Matlab Based High Speed Face Recognition System Using Som Neural Networks"Aug 2013 .
[13] Urvashi Bakshi, Rohit Singhal "A New Approach Of Face Recognition Using Dct, Pca, And Neural Network In Matlab"June 2013.
[14] A. S. Syed Navaz1, T. Dhevi Sri2 & Pratap Mazumder," Face Recognition Using Principal Component Analysis And Neural Networks ", International Journal Of Computer Networking, Wireless And Mobile Communications (Ijcnwmc) Issn 2250-1568 Vol. 3, Issue 1, Mar 2013, 245-256.
[15] Aman R. Chadha, Pallavi P. Vaidya, M. Mani Roja," Face Recognition Using Discrete Cosine Transform for Global and Local Features ", roceedings of the 2011 International Conference on Recent Advancements in Electrical, Electronics and Control Engineering (IConRAEeCE)
[16] Guo-Dong Guo And Hong-Jiang Zhang ," Boosting For Fast Face Recognition", Microsoft Research China 5f, Beijing Sigma Center No. 49, Zhichun Road, Haidian District Beijing 100080, P. R. China.
[17] Paul Viola , Michael J. Jones," Robust Real-Time Face Detection", International Journal Of Computer Vision 57(2), 137–154, 2004 C 2004 Kluwer Academic Publishers. Manufactured In The Netherlands.
[18] Paul Viola , Michael Jones ," Rapid Object Detection Using A Boosted Cascade Of Simple Features" , Accepted Conference On Computer Vision And Pattern Recognition 2001.
[19] Parin M Shah," Face Detection from Images Using Support Vector Machine"
[20] Cahit Gürel," Development Of A Face Recognition System".
[21] Yu-Hao Huang, chiou-Shann Fuh," Face Detection And Smile Detection".
[22] Sukanya Sagarika Meher , Pallavi Maben , "Face recognition and facial Expression Identification using PCA ", 978-1-4799-2572-8/14/$31.00_c 2014 IEEE.