IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Volume-4, Issue-7 E-ISSN: 2347-2693

Image Processing: Review on Face Recognition Approaches

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Available online at: www.ijcseonline.org

Received:06/Jun/2016 Revised: 20/Jun/2016 Accepted: 15/Jul/2016 Published: 31/Jul/2016

***Abstract*—** Face recognition in image processing is a challenging area in the field of computer vision. We recognize images in an efficient way using various techniques. Some of them are principal component analysis, Blurring techniques and Kernel methods. We present framework of these face recognition techniques and literature review is also provided. We apply wavelet transform on blurring techniques which is further trained with principal component analysis to check recognition rate.

***Keywords*—**Wavelet transform; Blurring techniques; Kernel Methods; PCA; Eigen values

I. INTRODUCTION

Face recognition in image processing is a challenging area in the field of computer vision. It is the process of identifying a person in a digital image in order to recognize his face by expressions and illuminations poses etc. Facial recognition systems are widely used for security purposes, face book, software applications and surveillances. Facial recognition software helps automate user tagging in photographs. It works each time an individual is tagged in a photograph, the software application stores information about that person's facial characteristics. When enough data has been collected about a person to identify them, the system uses that information to identify the same face in different photographs, and will subsequently suggest tagging those pictures with that person's name. Author in paper [14] gives an overview of Face recognition techniques and provide advantages and disadvantages. Authors in paper [12] provide an excellent review on image recognition. They explain and express kernel linear discriminant analysis, kernel principal component analysis and scale invariant feature transform in their paper. Authors in paper [7] survey digital image processing and highlighted a number of challenges viz. compression, visualization, reorganization, brightness preserving, image restoration etc. They apply de-convolution technique to remove the noise from the image in order to de-blur the image.

Principal component analysis algorithm (PCA) is initially studied by Karl Pearson in 1901. It is based on information theory approach in which the extraction of relevant information regarding face is extracted efficiently. It is a variable or dimensionality reduction procedure and is useful when obtained data have some redundancy. This will result into reduction of variable into smaller number of variables which are principal component. It uses eigen faces approach which helps in reducing the size of the database for recognition of a test image. The images are stored as their feature vectors in the database which are found out projecting each and every trained image to the set of eigen faces obtained. It is applied on eigen faces approach to reduce the dimensionality of a large data set. Authors in the paper [3] study the face recognition using principal component analysis and radial basis function neural network. They considered intra-class discriminating characteristics of the training images. This helps the Radial Basis Function Neural Network to acquire wide variation in the lower-dimensional input space and improve its generalization capabilities. Authors in paper [1] consider kernel principal component analysis as a mechanism for extracting facial features. A polynomial kernel is taken into consideration with principal component analysis in the product space of the input pixels making up a facial pattern. Authors in paper [10] stated that blurring is form of bandwidth reduction that is used to owing the imperfect image- formation process of an ideal image. Author in paper [15] explained blurring techniques like Motion blur, Gaussian blur, out of focus blur and Average blur that are present in the image. The de-blurring techniques are used to remove the noise from the images.

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II. LITERATURE SURVEY

A. *Literature Survey on PCA*

Principal component analysis (PCA) is one of the most popular methods for reducing the number of variables in face recognition. In PCA, faces are represented as a linear combination of weighted eigenvectors called as Eigen faces. In the last 10 years most of the work has been done on the PCA algorithm for face recognition.

Authors in paper [6] proposed that PCA can outperform over many other techniques when the size of database is small. In proposed algorithm, by using some features of interest in faces, the database was sub grouped. Only one of

the obtained subgroups was provided by PCA for recognition. On another way instead of good results of PCA, this technique has the disadvantage of being computationally expensive. With this it having complexity with the increase in database size, since all the image pixels are mandatory to obtain the representation used to match the input image with all others in the database. Different authors by doing experiments for plastic surgery has been concluded that the recognition rate of face recognition algorithms such as PCA, FDA, LBP, LLA & GNN is more than 40% for local plastic surgery. Author in paper [10] implemented the system using Japanese female facial expression (JFFE) database. There aim is to increase the accuracy as compared to the existing ones taking into consideration the time constraints Authors in paper [1] suggests PCA as powerful technique for extracting a structure from potentially high dimensional data sets. A kernel PCA, recently proposed as a nonlinear extension of a PCA computes the principal components in a high-dimensional feature space, which is nonlinearly related to the input space. Authors in paper [8] have developed the PCA based face recognition system in MATLAB 7.8.0 environment. They proposed that the recognition accuracy of the system is computed as the ratio of the faces recognized correctly from the test set over the total number of faces in the test set. They performed the 4 experiments on the individual image. They concluded that the PCA based face recognition; when the number of Eigen value increases it will directly increases the recognition rate. However, the recognition rate saturates after a certain amount of increase in the Eigen value. Increasing the number of images and variety of sample images in the covariance matrix increases the recognition rate however noisy image decrease the recognition accuracy. Author in paper [2] proposed that the minimum number of components in Eigen face, Kernel Eigen face and ICA based methods were empirical determined to achieve lowest error rates.

B. Literature survey on Kernel methods

Authors in paper [14] said that there is no any need of face manifold in subspace to be linear. Kernel methods are generalization of linear methods. The term manifold learning means the expression recognition. The explanation that when data points are represented in a higher dimensional space, it is observed that objects of the same category tend to lie relatively close to each other, which results[18] in a geometric structure in a higher dimensional space is provided by "University of Dayton". This geometric structure is called a manifold. "University of Dayton" proposed a robust mathematical model [18]. That model is used for representing complex manifolds formed by face or object images and a method to map test images to these manifolds. The method was tested and evaluated as shown in fig. 1 for face recognition."University of Dayton" gives the result that the proposed method is superior to other state of the art methods.

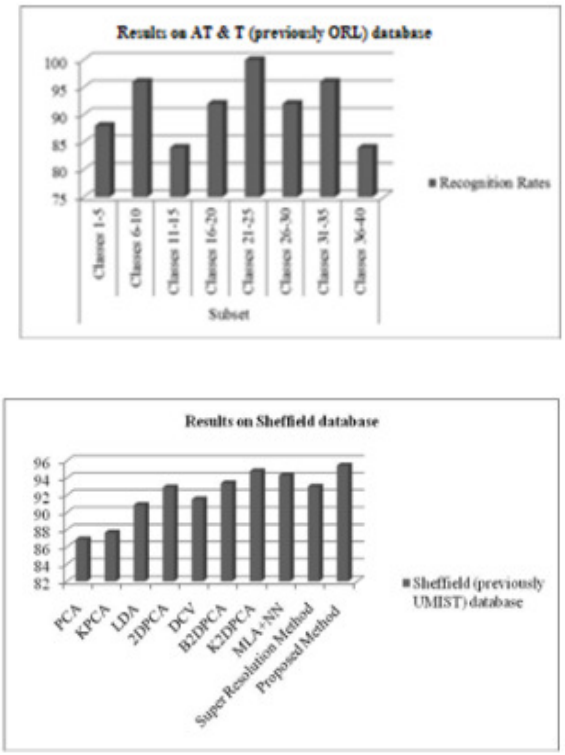

Fig. 1: Results of all approaches such as PCA, LDA, KPCA, DCV, H2DPCA, MLA-NN and more.

Author in paper [12] proposed two different Kernel Methods in the paper i.e. Kernel LDA and Kernel PCA. These both methods are having the different but good effect on face recognition. Kernel LDA (Linear Discriminant Analysis) is a very traditional method used for face extraction. It aims to maximize between class variance and minimize within class variance. With this it has a problem of sample size with high dimensional face data. Authors in paper [1] proposed kernel PCA as extension of a PCA. The basic idea of this is to map the input spaces into feature space via nonlinear mapping .Kernel PCA based on principle that since PCA in feature space can be formulated in terms of dot products in same space. So Authors in paper [17] had been proposed kernel based approach to solve face recognition problem under complex distribution by mapping the input space to high-dimensional feature space. The second well known method for feature extraction is Kernel PCA (Principal component analysis). In this probe image and gallery image must be of same size. As well as it must first normalized to line up the eyes and mouth of subjects. The advantage is that, it can reduce the data needed to identify the individuals to 1/100th of the data

presented. Although it has disadvantaged, that it requires full frontal face to be presented each time.

III. PROPOSED FRAMEWORK FOR FACE RECOGNITION

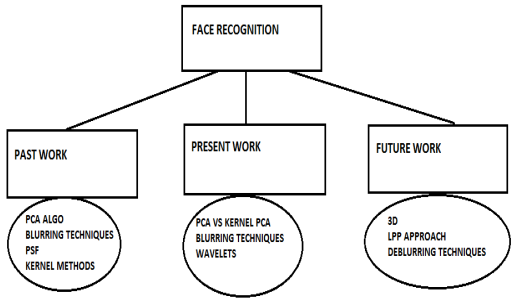

Fig. 2: A framework for face recognition in different panels.

This is a framework as shown in fig. 2 for the face recognition. Here the face recognition is divided into three main categories such as Past work (already be done), Present work (on which I am working) and the Future work (the work that will be done in future). Many of the different techniques, algorithms and parameters are used for face recognition. We apply wavelet transform on blurring techniques which is further trained with principal component analysis to check recognition rate. We will explain PCA, Kernel methods, Wavelet transforms and blurring techniques which is frequently used in face recognition.

IV. FLOWCHART FOR FACE RECOGNITION

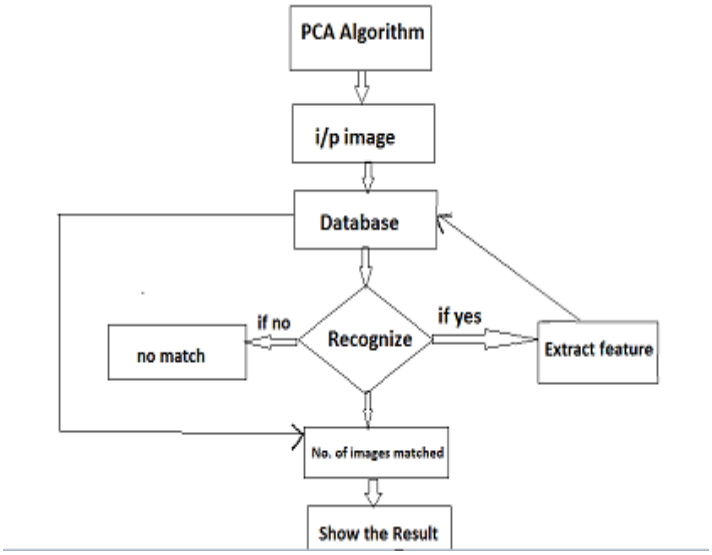

Fig. 3: Flowchart showing the working of PCA algorithm in database by giving ends results.

This flowchart shows the working of PCA algorithm as shown in fig. 3 to fetch the matched image form the database. When we use PCA algorithm on the input image that we want to fetch form the database the first it recognize the image, then there two conditions occurred; first if yes the it recognize the image then extract the features of that image from number of matched images and show the result but secondly if not then no match found.

V. CONCLUSION AND FUTURE SCOPE

In this paper, the past few years research is discussed that is done by many researchers in past. This paper has attempted to review a significant number of papers to cover the recent development in face recognition field. The list of references to provide more detailed understanding of the approaches described is enlisted. The PCA Algorithm, Kernel methods & Blurring techniques based on face recognition systems are overviewed. We apologize to researchers whose important contributions may have been overlooked. The methodology does make available a real-time solution to the problem of face recognition and it will work on other techniques for 3D face recognition.

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