International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 3 | Issue 5 | ISSN : 2456-3307

A Comparative Study on Face Recognition Techniques

Bharti Nagpal, Rajni Pathak
Assistant Prof (CSE), M. Tech (IS)

ABSTRACT

Face recognition technology is that when we recognize different feature (eyes, nose, mouth) of human face as we know the every human face is different to one another, so we have to discriminate an individual in computer applications. In real world there are so many practical applications where human identification is needed. Face recognition, as one of the primary biometric technologies, became more and more important owing to rapid advances in technologies such as digital cameras, the Internet and mobile devices, and increased demands on security. Now a days face recognition has been fast growing and widely used in big organization.in this paper we will comparative study the different methods for face recognition.

Keywords : EIGENFACES, SR, CR, PCA, LDC, LDA, ICA

I. INTRODUCTION

Face recognition is a process which is used by human in daily routine. Wide availability of powerful and low-cost desktop and embedded computing systems has created an enormous interest in automatic processing of digital images and videos in a number of applications, including biometric authentication, surveillance, human-computer interaction, and multimedia management. Research and development in automatic face recognition follows naturally. Face recognition, as one of the primary biometric technologies, became more and more important owing to rapid advances in technologies such as digital cameras, the Internet and mobile devices, and increased demands on security. Face recognition has several advantages over other biometric technologies: It is natural, nonintrusive, and easy to use. There are several key factors that can significantly affect face recognition system performances like pose variations, illumination variations, occlusion, time delay, low resolution and Age and change in expressions. Regarding these challenges, the researchers are always trying to evaluate the best face recognition algorithm. Different evaluations have been conducted by researchers this paper presents the challenges which hinder the face recognition and discuss the different algorithms which are used to solve face recognition problems with merits and demerits of these algorithms.

Face recognition steps

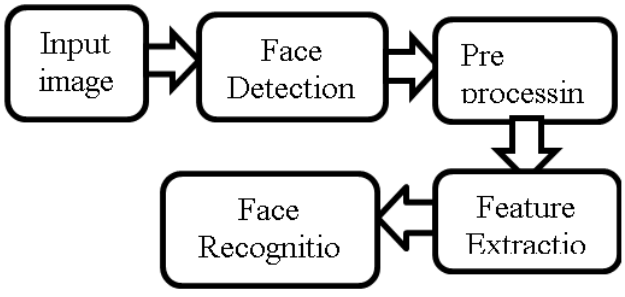


Fig:1.1 face recognition steps

1) Image.

This is input image which is used for recognition technique.

2) Face detection

In this step of face recognition technique firstly we have to take photo of the person by normal camera and then we detect that image through detection technique. There are two main point is 1.whether the face is present or not or 2. Where the face is located at.

After detect many face from image we make database of it. And it is used for comparison with test image.

3) Pre-processing.

In this step input image is processed like remove noise, enhance contrast.

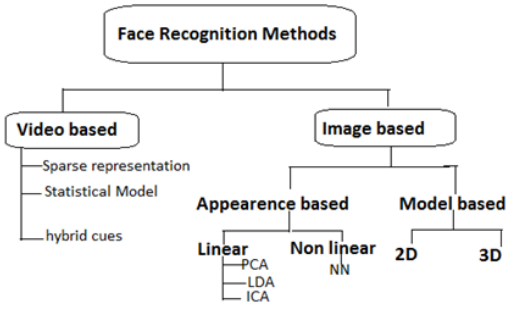
4) Feature extraction.

After face detection steps human face patches are extracted from the input image.

Feature extraction performed to do information packing, dimension reduction, noise cleaning.

5) Face recognition.

Face recognition is final and last step of face recognition technique. In this step face is compared with the constricted database. On basis of that comparison we can say face is known or not [11].



Face recognition methods.

A. PCA (PRINCIPAL COMPONENT ANALYSIS)

Principal component analysis [1] is a linear Appearance based face recognition method. It is useful when you have obtained data on a number of variables (possibly a large number of variables) believe that there is some redundancy in those variables. The method is based on an information theory approach that decomposes input face images into a small set of characteristic feature images called 'Eigen faces' which are actually the principal components of the initial training set of face images. An important feature of PCA is that one can reconstruct any original image from the training set by combining the Eigen faces. The technique used in creating Eigen faces and using them for recognition is also used outside of facial recognition. PCA is also used for handwriting analysis, lip reading, voice recognition, sign language/hand gestures interpretation and medical imaging analysis.

B. LDA (LINEAR DISCRIMINANT ANALYSIS)

Linear Discriminant Analysis [2] is a well-known scheme for feature extraction and dimension reduction. It has been used widely in many applications such as face recognition, image retrieval, microarray data classification, etc. Classical LDA projects the data onto a lower-dimensional vector space such that the ratio of the between-class distances to the within class distance is maximized, thus achieving maximum discrimination. The optimal projection (transformation) can be readily computed by applying the Eigen decomposition on the scatter matrices Linear discriminant analysis (LDA) and the related Fisher's linear discriminant are methods used in statistics, pattern recognition and machine

learning to find a linear combination of features which characterize or separate two or more classes of objects or events [8-9]. The resulting combination may be used as a linear classifier or more common

C. Neural Network (NN)

Neural networks [3] have been applied successfully in many pattern recognition problems, such as optical character recognition, object recognition, and autonomous robot driving. The advantage of using neural networks for face detection is the feasibility of training a system to capture the complex class conditional density of face patterns.

D. Eigen face

Eigen faces [4] is the name given to a set of eigenvectors when they are used in the computer vision problem of human face recognition for human identification.

The approach to face recognition [5] involves the following steps.

1. Acquire an initial set of facial images (which is used as training set).
2. Calculate the mean of all images.
3. Eigenvector [6], eigenvalue and Eigen face have been calculated.
4. Signature for each and every image has been calculated.
5. Subtraction of mean value from the index image which was picked randomly has been performed.
6. By comparing the signature value with the subtracted value the face can be recognition.

E. Gabor Wavelet.

Gabor wavelets is basically an image analysis process. They characterize the image as localized orientation selective and frequency selective Features. Therefore, low level features, such as peaks, valleys and ridges are enhanced by 2-D Gabor filters. Thus, the eyes, nose and mouth, with other face details like wrinkles, dimples and scars are enhanced as key features to represent the face in higher dimensional space. Also, the Gabor wavelet representation of face image is robust to misalignment to some degree because it captures the local texture characterized by spatial frequency, spatial position and orientation.

Table 1: Comparative analysis of face recognition techniques

Face Recognition methods.	Strength	Challenges	author	year
1. 2D (Model based)	• Large 2D image collection. • Cheap device available	• Pose variation cannot handle in this method. • Sensitive to shadow, variations of light.	Prof.K.Hema chandran and Ningthoujam Sunita Devi Yongsheng Gao	2013

2. 3D (model based)	• 3D can deal with pose variation(only if camera can capture the full face image) • Better accuracy than 2D. • Less sensitive to light, shadow.	• Devices are still expensive. • 3D Image collection at large scale are not available. • Time consuming model.		
3.Principal Component Analysis (PCA) (Appearance based) [9]	• Eigenvectors of the covariance matrix used for face image • PCA is quite simple and efficient method as compared to others recognition methods. • Unprocessed data are used. • No need of knowledge about geometry and significant of faces.	• PCA is very sensitive method as capered to other. • Frontal view is used for experiments. • Sensitive to pose variation as well as expressions. • It is time consuming learning because of its appearance based nature.	Deepali H. Shah, Dr. J. S. Shah and Dr. Tejas V. Shah3,	2014
4.Linear Discriminate Analysis (LDA) (Appearance based) [10]	• The Fisher face projection approach is aimed to solve the illumination problem by maximizing the ratio of between-class scatter to within-class scatter; however, finding an optimum way of projection that is able to simultaneously separate multiple face classes is almost impossible. • LDA based algorithms outperform PCA based ones, since the former optimizes the low dimensional representation of the objects with focus on the most discriminant feature extraction while the latter achieves simply object reconstruction.	• Main problem is that Singularity problem. • A critical issue using LDA, particularly in face recognition area, is the Small Sample Size (SSS) Problem. This problem is encountered in practice since there are often a large number of pixels available, but the total number of training samples is less than the dimension of the feature space. This implies that all scatter matrices are singular and thus the traditional LDA algorithm fail to use.	Prof. (Dr.) Harsh Dev, Nancy Goyal	2014

5.Independent Component Analysis (ICA) (Appearance based) [11]	• It used local images and factorial face code. • Take advantage of higher order statistics • Better characterization of data in an non-dimensional spaces.		Shermina.J,	2010
6. Neural Network (NN) [12]	• Easy to implement • Reduces misclassifications among the Neighborhood classes. • High Detection accuracy (apx.90 %)	• Sensitive to privacy. • Implementation is costly. • Accuracy is quite less as compared to other.	Prof. (Dr.) Harsh Dev, Nancy Goyal,	2014
7. Eigen face method Statistical method (video based)	• This method is automatic. • Detection is on real images. • independent on color or size of image	• Detection is difficult if position of eyes is disturbed.	Yang G; Xu F.	2011
8.Gabor wavelet[13]	• Better performance • Fast • Acceptable accuracy • Small training set	• High dimensionality • Slightly rotation invariance • Affected by complex background	Ripal Patel, Nidhi Rathod, Ami Shah,	2012

There are many advantages and disadvantages for these algorithms. After summarization for these techniques we can choose the better one which enable dealing with conditions that effect on face recognition like change in illumination, pose variation, change in expressions, Partial Occlusion and Noise and etc.

II. Conclusion

This paper we discussed the different methods and algorithms for face recognition that used in the various application areas such as information security, video surveillance, law enforcement, identity authentication, Also challenges which impeding facial recognition such as change in (illumination, pose variation, expressions, aging factors, alignment, plastic surgery partial occlusion and noise, etc.). Finally, we provided Merits and Demerits of face recognition techniques which deal with these conditions, And types of databases used with these techniques. Even though many previous face

recognition methods which have been proposed in previous, have shown significant promises but robust face is still difficult.

III. REFERENCES

[1]. Ijimas. Nature (London) 1991; 354 (56).

[2]. Vilas Khairnar, Sandesh Jaybhaye, Chi- Chang Hu, Rakesh Afre, T. Soga and Maheshwar Sharon, Carbon Letters, Vol. 9(3), (2008) 188-194.

[3]. C Dillon, K. M. Jones, T. A. Bekkedahl, C. H. Kiang, D. S. Bethune, M. J. Heben, (1997), Nature 386, 377-379.

[4]. Vilas Khairnar, Maheshwar Sharon, Sandesh Jaybhaye, Michael Neumann, SRINMC Vol. 36(2), (2006)171-173.

[5]. Sandesh V. Jaybhaye, Maheshwar Sharon, Dattatray E. Kshirsagar Carbon materials for energy application 2005; 171-178

[6]. Sunil Bhardwaj, Maheshwar Sharon, T. Ishihara, Sandesh Jaybhaye, Rakesh Afre, T. Soga and Madhuri Sharon, Carbon Letters Vol. 8(4),(2007) 1-7.

[7]. Brunauer S, Emmett P.H. and Teller E. J.Am.Chem.Soc,.60,309,(1938)

[8]. Quirk J.P. Soil sci.8, 423,(1955)

[9]. Dechnik I. and Stawinski J. Soil Sci.,3,15(1970)

[10]. Maheshwar Sharon, Sandesh Jaybhaye, D. Sathiyamoorthy and Sunil Bhardwaj, Proceedings of the International Conference on Molecules to Materials at Longowal, Punjab, March 3-4, 2006 pp. 50-52.

[11]. A. K. Chattarjee, Maheshwar Sharon, Ranjan Bannerjee, Michael Neumann Spallart - Electrochimical Acta 48 2003; 3439-3446