Survey of Modern Face Recognition Methods and Applications

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ABSTRACT

Face Recognition is the highly used method in security issues and also used in various applications. This technique highly used as the most reliable real time application for victim identification. This paper gives the study of evolution of face recognition method in each period and analyzing merit and demerit of the each evolutionary period. This paper helps to realize the importance of the face recognition technique.

KEYWORDS: Eigen faces, fisher faces, neural network, elastic bunch, graph matching, template matching.

1. INTRODUCTION

Face Recognition Technique is the method of realizing the people by matching two images or footage from video by considering the facial features. The Figure 1 which shown below indicates the process of face recognition.

Fig 1. Block Diagram of Face Recognition

Initially, as the block diagram indicated, face recognition technique wanted to detect the face. If any face in the particular image it will detect first [1].The next process is the Feature extraction in this method various features of the image will be detected. Some of the features are visual features, coefficient features, pixel features, luminous features and algebraic features which gives detailing of a particular image. By considering, above features the image details will be classified in the basis of certain criterion.

2. TECHNIQUES FOR FACE RECOGNITION

Eigen Face Method: Eigen faces are widely used face recognition method. This method is also known as the Eigen picture, Eigen vector, and principal component [2].The basis of the Eigen face method is Principal Component Analysis (PCA) which performs dimensionality reduction. Eigen face is the practical approach for the face recognition in which principle components are divided into feature vectors. Eigen faces are very easy to implement because of the simplicity in algorithm and storage space required is very low. It has high processing speed.The accuracy of Eigen face method depends on many things. There will be a high correlation between training data and recognition data. In Eigen face method single face images as well as double face images can also analyzed. In 1997, Dual PCA projections also proposed. Advantage of the system is identifying the necessary Eigen faces only to make system perform efficiently [3]. Demerit of the Eigen face method is very difficult to detect the faces in various head position and it is very sensitive to detect Eigen values in some lightening conditions. Sometimes the process of identifying the Eigen vectors and Eigen values are time consuming event.It is concluded that Eigen face method is simple, accurate method. It has wide variety of application such as motion tracking in films. Some drawbacks like sensitive to change in light, direction, angle, position and distance are there. Even though there is drawback it provides good results.

Fisher Faces: Fisher faces is based on the appearance method which is widely used in the face recognition method [4].R.A Fisher developed the linear discriminant analysis for face recognition during 1930s.[3]In this method the various classes with in the image will be detected but the demerit of this method as it shows less accuracy in various lighting conditions.

Elastic Bunch Graph Matching: As the name mentioned above this face recognition technique is using a data structure named bunch graph. Here the land marks are identified by this bunch graph [5].The features are extracted from the images and detect the face by taking the number of instances of Gabor filter which is called as the Face Graph. In this method images are compared with the graph and will generate a new graph. A Particular image graph shows its jet orders such as spatial arrangement it will compare with the other image if it is matched with the other one then we can easily analyze the matching of the two images. Sometimes the direction, spatial order, rotation and distortion will give increased similarity. [3]The main advantage of this method is missing of one vector cannot be led to the missing of the face. If a new face is recognized by this

method it will automatically save in the database. We can say the demerit of this method as the recognition rate is less when change in lightening is large.

Hidden Markov Models Method: Hidden Markov Method (HMM) is well promised for detecting the face in the difficult conditions such as variation in lighting, facial expression and orientation. The objective of this method is to find out the hidden parameters from the observable parameters. It will perform well in speech signal as well as character recognition. Probability distribution method is highly used to recognize the hidden parameters from observable one. Sometimes in HMM method 2D discrete cosine transform can also be used to feature vector [6].In many tests it is proved that HMM method is better than Eigen faces when we compare the image with variations.

Principal Component Analysis: Dimensionality Reduction is the statistical method for principal component analysis. In this method there is a serious problem in accuracy and classification time [13][14].Even though this method is also powerful tool for the face recognition technique.

Discrete Cosine Transform: Discrete Cosine Transform (DCT) is using for transforming images, compacting the variations, allowing an effective dimensionality reduction.[13]It has a strong energy compaction properties. When DCT applied to image the energy will compact to the upper left corner.

Linear Discriminant Analysis: Linear Discriminant analysis (LDA) is used to find linear combination of the features between the classes in the images while the modeling. Two demerits are introduced in 2014 by Murtaza et al. The prime demerit is about the instability of theLDA when number of samples in the intra class is smaller than dimensionality of the sample in the training phase. Second demerit is the higher computational cost[13].For solving the problem, applied an Adaptive Margin Fisher's Criterion Linear Discriminant Analysis (AMFC-LDA).When this algorithm applied far more better results are obtained.

Neural networks Algorithms: These algorithms are used as the research tools in the face recognition method. This may be used along with the Gabor filter in order to overcome illumination variations. It will give better results by applying the multi-layer perceptron with back-propagation algorithm. This method gives better results in which fuzzy neural networks is the latest approach.

Gabor Wavelet: This function provides conjoint resolution of information in the 2D Spatial and 2D Fourier domains. Gabor Wavelet is spatial band pass filter. When we consider the image it will classified into four different dimensions. Two spatial directions and other two spatial frequencies [15]. The local image features can also detect by the Gabor Wavelet. These are biologically motivated convolution kernels of different orientations and frequencies. This type one image pixel is known as jet [3].

Template Matching: Consider a test image which is two dimensional array of intensity values, such as Euclidean distance. [13]In which a face is representing with single template. For analyzing a particular person's face we can use different types of templates. The main drawback of this method is the complexity in the computations. Descriptions in these templates also faces the another problem. There may be some feature changes between the template and the test image which leads to average out the differences that make individual faces unique.

Graph Matching: Graph Matching is another method of Face Recognition. Here the elastic graph matching helps the dynamic link structure for distortion invariant object recognition to find the closest stored graph [12].The image vertices are labeled with a multi resolution description in terms of a local power spectrum, where the edges also labeled with the geometrical distance vectors. Object recognition is obtained by the elastic graph matching.

3D model: 3D data usage increased the opportunity of working predominately with the face recognition technique. Camera always captures the image which is come after the reflection from the body. Many factors depend upon this reflected image such as surface geometry, albedo, brightening, contrast, illumination and spatial characteristic. The only way of detailed analysis of the image is to apply 3D Model analysis [7].3D model always gives the various parts in the images, align the model and cover various property analysis [8].

Infrared: Infrared analysis obtained by considering the thermo grams that is calculating the amount of heat discharged from an object. The temperature discharged from an object varies with another one because this depends upon the various properties such as characteristics of material and temperature of the object itself. Thermal image analysis is very popular in these days. It happens by analyzing the temperature generated by

blood vessels under the facial skin [9].Particular camera is used to detect the thermal variation and detect the images [10]. [11]When the two images provide the same spectra of information we can conclude that the person is same. In conclusion, each method has its own demerits. So the advanced methods want to be applied for improving the greater results.

3. GENERAL SURVEY OF FACE RECOGNITION

In 1950 s computer scientists developed the computer system such a way that it used sophisticated mathematical representation and increased the quality of matching process which is far better than the early years. In 1960s, Woodrow Wilson Bledsoe, who is known as the father of face recognition developed automated face recognition technique. Even though it was the initial invention, the image analysis must need the manual help. Although Gold stein, Harmon and Lesk tried to improve manual face recognition system which continued till late 1980s.

In 1980, predominant growth of computer evolution taken place, which also developed the face recognition techniques. In early 1980, According to George Orwell the members of the society always recognized by a computer system even though they were in a distant place. In 1990, Kirby and Sirovich introduced a solution to influence of manual presence in Image analysis by applying principal component analysis which is standard algebraic technique. It provided more detailed images than earlier techniques so this can be considered as a mile stone in the field of face recognition technique.

In 1991, a significant breakthrough happened when the Turk and Pentland applied Eigen face approach to detect faces from the image by analyzing the residual error. This new technique enabled a reliable real time face recognition solution which later applied in social security systems. During the period of 1993 to 2000 ,in order to increase the encouragement in the field of face recognition technique The Defense Advanced Research Projects Agency (DARPA) and the National Institute of Standards introduced Face Recognition Technology (FERT).The objective of this program to build the face images and they succeeded to collect 2,413 still facial images representing 856 people which pointed out the enormous possibilities of face recognition technique in various fields such as survey, criminal database development etc.

In 2002, Law enforcement official reported that even though criminals can be found using the face recognition system, sometimes failed due to the limitation in technical side. Face recognition become difficult when in the large crowd. So face recognition cannot consider as the best way for security in those times. Latest face recognition algorithms were introduced in 2006, as the part of Face Recognition Grand Challenge (FRGC). High resolution face images, 3-D face scans and iris images were used in this test. Result of this test assured 10 times more accurate than the face recognition algorithms of 2002 as well as 100 times more accurate than those of 1995.Its precision and accuracy promising that it would identify even identical twins.

Nowadays, Face recognition techniques are highly applicable in many fields such as forensic databases to recognize the criminal using matching the camera footage with the early stored one. It is also using in the social media application for tag people by detecting the face from images. Many airports are now under camera

observation for security reasons this is another application of the same. So face recognition becomes great application in current situations.

4. CONCLUSION

Face Recognition Technique is a popular scientific technique which has enormous application also. So face recognition technique also vulnerable to many challenges. Nowadays most of the crimes are detecting using the help of image analysis. We discussed in this paper about the evolution of the face recognition technique. In each period this technique improved even though we experienced some demerits in every stage. Finally face recognition technique become very accurate and largely used in many fields. We went through many algorithms and methods to increase the efficiency of the face recognition technique. It is sure that, in future, new algorithms can also be applied in this technique to improve the performance more than more accurate.

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