Comparison of FaceRecognition Techniques

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Abstract*—Now-a-days,Face Recognition has become a challenging problem. It has got many diverse applications like in individual identification, Security, Surveillance etc. A facial recognition system automatically identify or verify person from a digital image or a video frame with respect to stored database. Some of the Face recognition techniques are appearance based which use Eigen faces, some are feature based and some other are hybrid methods.This paper mainly demonstrates the comparative study, Pros and cons of different face recognition techniques.

Keywords - FaceRecognition, Appearance based techniques, Eigen faces,feature based techniques, Hybrid methods.

I. INTRODUCTION

Face Recognition techniques play a very important role in the field of security and surveillance. It is different from other biometric recognition because faces are multidimensional and almost all human faces have similar structure. Face Recognition system should automatically detect a face in an image which includes extracting features, and recognizing them even under adverse lighting, illumination and pose of face images.Among many issues, most important issues associated with facial recognition are the type, format and composition of the face images used for the recognition. Several factors should be considered to develop a useful and applicable face recognition system such as:

i) Overall speed of the system should be acceptable.

ii)High accuracy.

iii) The system should be easily updated and enlarged so that it works easily even if we increase number of subjects to be recognized.

In order to recognize a face, Appearance based techniques(Holistic Matching method) use Eigen faces. Feature based techniques extract features such as eyes, Nose and mouth and fed their locations,local statistics into a structural classifier. Hybrid methods use a combination of both Holistic andfeature extraction methods. In general, they use 3D images for recognition. This paper about Face recognition techniques is further organized as follows, Section II presents some related work. Section III provides the technical analysis of all three techniques.Section IV enlists the experimental analysis, Section V provides its applications and section VI summarizes and provides the conclusion, future scope.

II. PREVIOUS WORK

Bledsoe's[1] and Kanade's[2] early systems introduced a number of automated or semi-automated face recognition strategies which have modeled and classical faces based on normalized distances and ratios among feature points. Later work done at Bell Labs (Harmon, Goldstein& Lesk;Harmon, 1971)developed a vector of up to twenty one features, and recognized faces with the help of standard pattern classification techniques. A Paper by Fishcler and Elschlager(1973) [3] described a linear embedding algorithm that used local feature template matching and a global measure of fit to find and measure facial features. These systems were continued and improved by the recent work of Yuille et al.[4].Fleming and Cottrell(1990) [5] , building on earlier work by Kohonen and Lahtio(1989)[6] use non-linear units to train a network via back propagation to classify face images.

III. TECHNICAL ANALYSIS

There are mainly two approaches. One way is using general algorithms like appearance based, feature based and hybrid methods and another one is AI centric (e.g. Supervised and unsupervised learning methods such as Neural Networks etc).Out of these two approaches, we are going to understand generic algorithms approach in detail.

A. APPEARANCE BASED TECHNIQUES

Each individual face can be represented exactly in terms of a linear combination of the Eigen faces. The approximation of each face use only the "best" Eigen faces which have the largest eigenvalues and therefore which account for the highest variance

within the set of face images.Usage of eigenvalues was motivated by a technique developed by “Kirby and Sirovich ”[7] ,the weights describing each face are found by projecting the face image onto each eigen picture.Each individual therefore, would be characterized by the small set of features or eigen picture weights.

Holistic Matching Method works according to these steps:

I) Insert a set of images called training set into database to compare images and when we create the eigenfaces.

ii) Create the Eigen faces by extracting characteristic features from the faces.The input images are normalized to line up the eyes and mouths and then resized so that they have the same size to have the eigen faces extracted from the image data by using “Principal Component analysis”.

iii) Each image is represented as a vector of weights.

iv) The system is now ready to accept queries.

v) The weight of the unknown image is found and then compared to the weights of the images in database.

Vi) If the image’s weight is over a given threshold,it is considered to be unidentified or if the weight of the input mage is closer to any of the image weights of database,it is identified/hit to the user of the system.

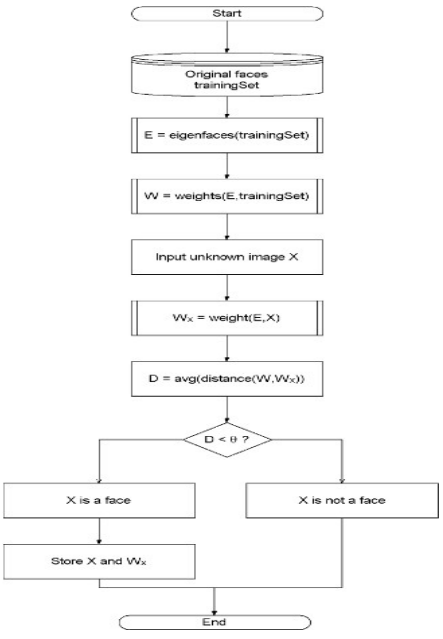

Fig 1: Flow chart of the eigenface based algorithm.

B. FEATURE BASED TECHNIQUES

It will be easy to rank or order the heights or weights of two persons, but it is hard to answer their precise differences. The absolute intensity information linked with an face can vary as it can undergo many changes under various illumination settings.

The Locations and local statistics of the extracted face features are given to a structural class ifier to recognize a face. "Feature restoration" is the biggest challenge for face recognition , because due to large variations in illumination and pose,It becomes tough when system tries to retreive features that are invisible. Again in feature based approach , there are three different extraction methods: Generic methods, Feature template based, Structural matching methods.

C. HYBRID METHODS

These Methods comprises of both Holistic as well as feature extraction methods. In order to recognize a face using hybrid method, A Person's face is caught in 3D,and the system notes the curves of eye sockets, or shapes of the chin,forehead. The hybrid method face recognition process works in this manner:

Detection :Capturing a face

Position: Determines the location, size and angle of the head.

Measurement: Assignment of measurements to each curve to make a Template

Representation: Template conversion to code.

Matching: Comparison with respect to faces in database.

Biggest challenge in this method is to see that if photos in 2D should be compared with 3D image, it requires few changes.

IV. EXPERIMENTS AND RESULTS

A. TRAINING DATABASE AND TEST IMAGE

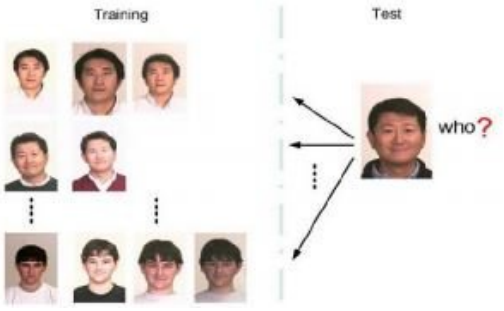

Fig 2: Face Recognition Scenario

I used AT&T face Database which comprises of 400 images(i.e.10 different poses of 40 persons).

Fig 3: Sample Training set from ORL datbase

To recognize a face, we have to load our database into Matlab first, then we run face recognition source code which recognize a unique person from those 400 images and display the found result.

B. RESULT OF FACE RECOGNITION

Fig 4:Sample output of Face recognition

C .GRAPH FOR ACCURACY RATE

Accuracy (Recogniton rate) is defined as how accuratley system could recognise the given image among the database images. On addition to the above source code ,If we add few code lines to find accuray rate.It would result in a graph which has relation between number of persons in Database and Accuracy rate.

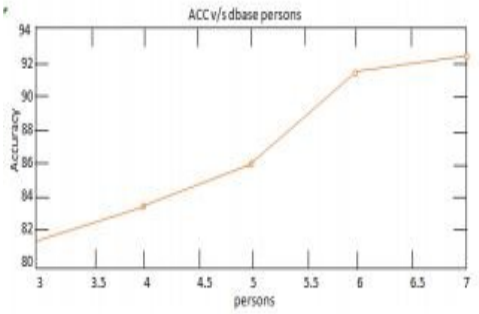

Fig 5:Accuacy Vs Number of persons graph

D. PROS AND CONS OF DIFFERENT METHODS

A.APPEARANCE BASED TECHNIQUE

PROS: 1)Applicable to low resolution or poor quality images

2)Fast,efficient and Recognition rate is 98%.

CONS:1) only works good with frontal faces

2)the prior (expert) knowledge of the human faces is not utilized.

3) limitations in facial variations, such as 3D pose, illumination and expression.

4) Sufficient representative data isneeded to sample the underlying distribution successfully.

B.FEATURE BASED TECHNIQUE

PROS: Recognition rate is almost 100%.

CONS:1)Feature Restoration

2)Computational Complexity

C.HYBRID METHODS

PROS:1)Complexity is less.

2)Recognition rate is 95%

CONS: Usage of large number of features

V. APPLICATIONS

Face Recognition has many useful applications in real world such as Face Identification, Access control in companies for login purposes, Security in public places like airports, Image database Investigations, General Identity verification and also Surveillance Purposes.

VI. CONCLUSION

I presented about different face recognition Techniques and their Pros, Cons in this paper. Since years, Lot of research work was being done in this field to excel in Image processing, Computer vision. I conclude that there are advantages as well as disadvantages for all the Techniques, So it is recommended to select the technique according to the image constraints and other factors like illumination, pose etc. In Future, algorithms which can restore features of a face even with worse illumination, pose should be developed.

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