Image Processing Techniques in Face Recognition

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***Abstract* - Face recognition has become one of the popular area of research in computer vision and one of the most successful applications of image analysis and understanding. It can be used for both verification and identification.**

***Keywords*-Face Recognition, Active Appearance Model Principal Component Analysis, Image Processing, KernelPCA**

I. Introduction

In recent years face recognition has received substantial attention from researchers in Biometrics. A Biometrics is a Unique, able to measure characteristic of human being. That can be used to automatically recognize an individual identity. Face recognition Technology (FRT)[1] is used in several disciplines such as image processing, pattern recognition, Computer vision etc. Face recognition fall into two categories: Verification and Identification. Face Verification is a 1:1 match that compares the given individual and gives decision as Yes or No. Face Identification is 1:N problem that compares a query face image with images in face database to identity the query face.

A.The Watch list:

This method is an open universe test. The tested individual may or may not be in the system data base. The problem of machine recognition of human faces continues to attract researches from disciplines such as image processing, pattern recognition, Neural Networks, Computer vision, Computer graphics and Psychology.

Human face recognition is a difficult problem in computer version. Face recognition is a challenging, because, it is a real world problem. The human face is complex, natural object that tends not to have easily identified edges and features.Face Recognition system is capable of extracting and picking up faces from the crowd and it is to be compared with an image in the data base.

II. Face Recognition

Face recognition represents good compromise between what's socially acceptable and what's reliable, even when operation under controlled conditions. In last decade many algorithms based on linear/nonlinear methods, neural Network, Wavelets, Kernel Fisher analysis method etc.

A. Appearance based face recognition:

Appearance based methodsshow an object in terms of several object views. An image is considered as a high dimensional vector ie. a point in a high dimensional vector space. Many view based methods use statistical techniques to analyze the distribution of the object image vectors in the vector space, and obtain an efficient description according to different applications. Given a test image the similarity between the stored prototypes and the test view is then carried out in the feature space.

B.Linear Analysis:

Three classical linear appearances based classifiers PCA, ICA, LDA. Each classifier has its own representation of a high dimensional face vector space based on different statistical view points.

C.PCA (Principal Component Analysis)

PCA is one of the successful techniques used to the original data with lower dimensional features vectors. This procedure transforms a number of correlated variables into a number of unrelated variables called Principal Components. PCA[9] is a powerful tool for analyzing data. The main advantages of PCA are to find the patterns in the data and reducing the number of dimensions without loss of information's. Purpose of PCA is to reduce the large dimensionality of the data space to the smaller intrinsic dimensionality of feature space.

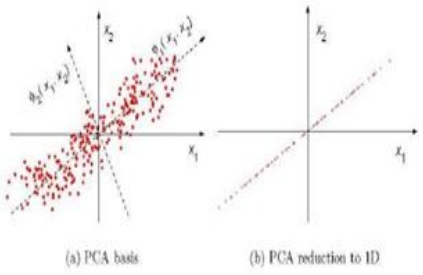

Fig 1.ICA (Independent Component Analysis)

Independent Component Analysis (ICA) is similar to PCA except that the distribution of the components is designed to be non-Gaussian distribution. Largest variances would not correspond to PCA basis vectors. ICA[4] minimizes both second order and high order dependencies in the input data and attempts to find the basis along which the projected data are statistically independent[5].

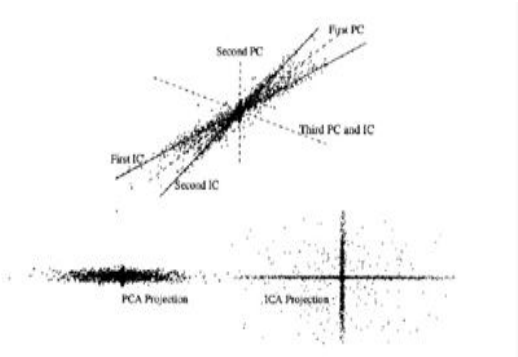

Fig 2.LDA (Linear Discriminates Analysis)

Both PCA and ICA construct the face without using the face class information. The whole face training data is taken as a whole. In LDA the goal is to find an efficient or interesting way to represent the face vector space. LDA mainly used for data separation Techniques. This approach is also known as fisher-surface approach. LDA find the linear transformations such that feature cluster are most separable after transformation.

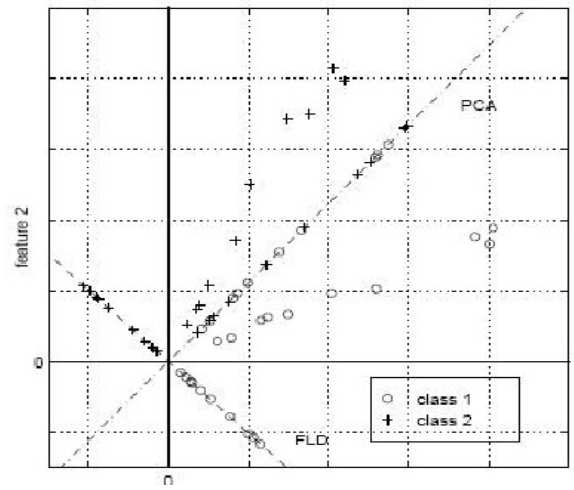

Fig3. Non –Linear Analysis

D.Kernel PCA

KPCA is a development of the PCA (eigenfaces) method. PCA method is used in the Feature extraction step of a face recognition system. Face image data has a very high Dimensionality. Classification on such a data would be extremely difficult; therefore, we need to reduce the dimensionality of the data. The reduced dimensionality data would contain only important features that we need in order to perform classification. PCA Performs very well in reducing the dimensionality of the data. However, the performance of PCA method (or other linear methods) is not completely satisfactory for problems with high 54 Nonlinearity, such as face recognition. Basically, the KPCA is used to tackle the nonlinearity of Face recognition problem. By using a nonlinear kernel function, a dimensional reduction (i.e., nonlinear projection) is performed. The images are first transformed from image space into a Feature space. In the feature space, the manifolds of the data become simple.

E.Small Sample Size

In real applications, current appearance based face recognition system encounter difficulties due to the small number of available training face images and complex facial variations during the test. Human face appearances have a lot of variations due to varying lighting conditions, different head poses and facial expressions. In real world situations, only a small number of samples for each subject are available for training. If a sufficient amount of enough representative data is not available, Martinez and kak have shown that the switch from non-discriminate techniques (PCA) to discriminate approaches (LDA) is not always warranted and may sometimes lead to poor system design when small and non-representative training data sets are used.

III.Methodology

Model Based Face Recognition:

The Model-Based face recognition[2][3] scheme is aimed at constructing a model of the human face, which is able to capture the facial variations. The prior knowledge of human face is highly utilized to design the model.

2D Morphable Model:

Elastic Bunch Graph Matching:

This approach has used the structure information of a face which reflects the face that the images of the same subject's trend to translate, scale, rotate, and deform in the image plane. It makes use of the labeled graph, edges are labeled, and the distance information and nodes are labeled with wavelet coefficients in jets. This model graph can then be used to generate image graph. The model graph can be translated, scaled, rotated, and deformed during the matching process. This can make the system robust to large variation in the images.

AAM (Active Appearance Model)

Active Appearance Model (AAM)(Cootesetal, 1998) is one of the well-known resourceful method in feature extraction and understanding of a face. This model is a generalization of widely used active shape model approach, which includes high memory procedure for the storage shapes and testers of all the models, general computations requirement to decide the model required for query images. The goal of Active Appearance Model is to attainbetter performance with the model to restrain solutions to be valid examples of the objectives modeled. AAM[7] method uses the full vector to drive the search, rather than a simple fitness score. Each attempt to match the model to a new face image is actually a similar optimization problem.

3D- Morphable Model:

Human face is a surface lying in the 3D space intrinsically, therefore, in principal, the 3D model[6] is better for representing faces, especially to handle facial variations, such as pose, illumination. It is a proposed method that encodes shape and texture in terms of model parameters and an algorithm that recovers these parameters from a single image of a face. For face identification, we see the shape and texture parameters of the model that are separated from imaging parameters, such as pose and illumination.

There are two methods of capture:

Video imaging

Video imaging[8] uses video cameras. System performance depends on precise position, angle of the head and surrounding lighting condition.

Thermal imaging:

Thermal imaging along with facial temperature variationhas more accuracy&it is very costly.

Components of FRT:

All identification and authentication technologies operate using the following:

Capture: A Physical or behavioral sample is captured by the system during enrollment and also in identification or verification process.

Extraction: Unique data is extracted from the sample.

Comparison: Compared with a new sample.

Match/ non match: The system decides if the features extracted from the new samples are aequivalent or not. It starts with a picture, attempting to find a person in the image. Mark the head and eye position. A matrix is then developed based on the characteristics of the individual face (eye, mouth, nostrils).

Implementation of face Recognition System following Stages:

- Data acquisition
- Input processing
- Face image classification and decision making.

Data Acquisition:

The input can be recorded as video. A sample of 1 sec duration consists of 25 frame video sequence. More than one camera can be used to produce a 3D representation. It helps to protect against the usage of photographs to unauthorized access.

Input Processing:

A pre-processing module marks the eye position and alsolooks after the surrounding lighting condition and color variance. After the face is detection, localization and normalization are carried out. The appearance of the face can change considerably during speech and due to facial expressions.

How Face Recognition System works:

Face recognition system work by a particular software. There are about 80 nodal points on a human face. Here are few nodal points that are measured by the software:

- Distance between the eyes
- Width of the nose
- Depth of the eye socket
- Cheekbones
- Jaw line
- Chin

These nodal points are measured to create a numerical code, a string of numbers that represent a face in the database. This code is called face print. Only 14 to 22 nodal points are needed for detecting face and complete the recognition process.

- Nodal Point
- Alignment
- Normalization
- Representation

- Matching

Alignment:

Once a face is detected the system determine the heads position, size and pose. A face needs to be turned at least 35 degree toward the camera for the system to register it.

Normalization:

Normalization is performed regardless of the heads location and distance from the camera.

Representation:

This coding process permit for easier comparison of the newly captured facial data to saved.

Matching:

The new captured facial data is compared to the saved data.

IV.Conclusion:

Face recognition methods have been related with very expensive secure applications. Some applications of face recognition technology are economical, reliable and highly accurate. So there is no technological or financial obstacletomoveto widespread deployment**.**

References

[1] LaurenzWiskott, Jean-Marc felloous, "Face Recognition by Elastic Bunch Graph Matching," In Intelligent Biometric Techniques in Fingerprint and Face Recognition, 1999.

[2] Volker Blanz and Thomas Vetter "Face Recognition Based on Fitting a 3DMorphable Model "SEPTEMBER 2003.

[3] D. Beymer and T. Poggio, ªFace Recognition from One Model View,º Proc. Fifth Int'l Conf. Computer Vision, 1995.

[4] Back, A. D. and Weigend, A. S. (1997). A first application of independent component analysis to extracting structure from stock returns. Int. J. on Neural Systems, 8(4):473–484.

[5] Bell, A. and Sejnowski, T. (1997). The 'independent components' of natural scenes are edge filters. Vision Research, 37:3327–3338.

[6] S. Romdhani and T. Vetter.Efficient, robust and accurate fitting of a 3D morphable model.In *ICCV*, 2003.

[7] T. Cootes, G. Edwards, and C. Taylor.Active appearance models. In Proceedings of the
European Conference on Computer Vision, volume 2, pages 484–498, 1998.

[8] G. J. Edwards. Learning to Identify Faces in Images and Video Sequences. PhD thesis, University of Manchester, Division of Imaging Science and biomedical Engineering, 1999.

[9] J. Yang, D. Zhang, A.F. Frangi, and J.Y. Yang. Two-dimensional PCA: a new approach to appearance-based face representation and recognition. IEEE Transactions on Pattern Analysis and Machine Intelligence, 26(1):131–137, 2004.