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Survey on Face Recognition

Khushboo, Sachin Srivastava

P.G. Student, Department of Computer Science, Satya College Of Engineering & Technology, Palwal, Haryana, India
Assistant Professor, Department of Computer Science, Satya College Of Engineering & Technology,Palwal, Haryana, India

ABSTRACT: Two of the most critical requirements in support of producing reliable face-recognition systems are a large database of facial images and a testing procedure to evaluate systems. The Face Recognition Technology (FERET) program has addressed both issues through the FERET database of facial images and the establishment of the FERET tests. To date, 14,126 images from 1,199 individuals are included in the FERET database, which is divided into development and sequestered portions of the database. In September 1996, the FERET program administered the third in a series of FERET face-recognition tests. The primary objectives of the third test were to:
1) assess the state of the art,
2) identify future areas of research, and
3) measure algorithm performance.

KEY WORDS: Classification, Predictive analysis, Social Networking Spam, Spam detection.

I.INTRODUCTION

A **face recognition system** is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source.One of the ways to do this is by comparing selected facial features from the image and a face database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris re-cognition systems. Recently, it has also become popular as a commercial identification and marketing tool. The face recognition problem can be divided into two main stages: face verification (or authentication), and face identification (or recognition). The detection stage is the first stage ; it includes identifying and locating a face in an image. The recognition stage is the second stage ; it includes feature extraction , where important information for discrimi-nation is saved, and the matching, where the recognition result is given with the aid of a face database. face recognition methods have been proposed. In the vast literature on the topic there are different classification of the exist-ing techniques. The following is one possible high-level classification : *Holistic Methods*: The whole face image is used as the raw input to the recognition system. An example is the well-known PCA-based technique introduced by Kirby and Sirovich, followed by Turk and Pentland. *Local Feature-based Methods*: Local features are extracted, such as eyes, nose and mouth. Their locations and local statistics (appearance) are the input to the recognition stage. An example of this method is Elastic Bunch Graph Matching (EBGM).

II. TECHNIQUES FOR FACE AQUSTION

A. Traditional

Some face recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw.[3] These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. One of the earliest successful system is based on template matching techniques- applied to a set of salient facial features providing a sort of compressed face representation. Recognition algorithms can be divided into two main approaches, geometric, which looks at distinguishing feature or photometric, which is a statistical approach that distills an image into values and compares the values with temp -lates to eliminate variances. Popular recognition algorithms include principal component analysis using eigenfaces,

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B. 3-dimensional recognition

A newly emerging trend, claimed to achieve improved accuracy, is three-dimensional face recognition. This tech-nique uses 3D sensors to capture information about the shape of a face. This information is then used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose and chin. One advantage of 3D face recognition is that it is not affected by changes in lighting like other techniques. It can also identify a face from a range of viewing angles, including a profile view. Three-dimensional data point from a face vastly im-prove the precision of face recognition. 3D research is enhanced by the development of sophisticated sensors that do a better job of capturing 3D face imagery. The sensors work by projecting structured light on the face up to a dozen or more of these image sensors can be placed on the same CMOS chip. Each sensor captures a different part of the spectrum. Even a perfect 3D matching technique could be sensitive to expressions. For that goal a group at the Technion applied tools from metric geometry to treat expressions as isometrics. A company called vision Access created a firm solution for 3D face recognition. All these cameras will work together so it can track a subject's face in real time and be able to face detect and recognize.

C. Skin texture analysis

Another emerging trend uses the visual details of the skin, as captured in standard digital or scanned images. This technique, called skin texture analysis, turns the unique lines, patterns, and spots apparent in a person's skin into a Mathematical space. Tests have shown that with the addition of skin texture analysis performance in recognizing faces can increase 20 to 25 percent.

III. SOFTWARE

Notable software with face recognition ability include:

digiKam (KDE)	iPhoto (Apple)
OnTime Pro (ClockedIn)	Lightroom (Adobe)
OpenCV (Open Source)	OpenFace (Open Source)
Photos (Apple)	Photoshop Elements (Adobe Systems)
Google Photos (Google)	Picture Motion Browser (Sony)

IV. PERFORMANCE MEASURES

In face recognition & biometrics, performance is reported on three standard tasks; verification , open-set & closed-set identification. Each task has its own set of performance measures. All three tasks are closely related, open set Identification being the general case. A biometric system works by processing biometric samples. Biometric samples are recordings of a person that allows that person to be recognized. Examples are facial images & finger print A biometric sample can consist of multiple recordings. For example five images of a person acquired at the same time or a facial image & a finger print. Computing performance requires three set of images. The first is a gallery G which contains biometric samples of the people known to a system. The other two are probe sets. Closed-set identification is the classic performance measure used in the automatic face recognition community, where it is known as identification. In open-set identification , the person in the probe does not have to be somebody in the gallery. In open-set identi-fication , a system has to decide if the probe contains an image of a person in the gallery. If a system decides that a person is in the gallery. In a verification task, a person present a biometrics sample to a system & claims an identity.

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V. FACE RECOGNITION ALGORITHM

A) **Principle Component Analysis (PCA)** :- PCA also known as Karhunen-Loeve method is one of the popular methods for feature selection and dimension reduction. Recognition of human faces using PCA was first done byTurk and Pentland and reconstruction of human faces was done by Kirby and Sirovich .The recognition method known as eigenface method defines a feature space which reduces the dimensionality of the original data space. This reduced data space is used for recognition. But poor discriminating power within the class and large computation are the well known common problems in PCA method. This limitation is overcome by Linear Discriminant Analysis (LDA). LDA is the most dominant algorithms for feature selection in appearance based methods . The reason is that LDA has the small sample size problem in which dataset selected should have larger samples per class for good discriminating features extraction. Thus implement-ing LDA directly resulted in poor extraction of discriminating features.

Methodology: Find the principal component use the following method:

Get the data: Suppose X1, X2....., XM is N x 1 Vectors

$X = 1/M \sum^{M}_{i=1} X_i$

Subtract the Mean: $\phi_i = X_i - X$

Calculating the covariance matrix: form of matrix A = [Φ1, Φ2….ΦM] (N x M matrix) then compute

$C = 1/M \sum_{n=1}^{M} \phi_n \phi_n = A^T$

Calculating the eigenvector and eigen value of the covariance matrix.

Choosing components and forming a feature vector: Once eigenvectors are found from the covariance matrix, the next step is to order them by eigenvalue, highest to lowest. This gives the components in order of significance. The eigenvector with the highest eigenvalue is the principle component of the data set. Choose the highest eigenvalue and forming a feature vector.

Deriving the new datasets: Once chosen the components (eigenvectors) that wish to keep in the data and formed a feature vector, imply take the transpose of the vector and multiply it on the left of the original data set transposed. PCA is basically a technique to represent the feature vector in the lower dimensionality space. So, by considering all the pixel values of image as the feature vector, we are getting better representation of image. That is why this technique is working better than DCT based technique even in large pose and illumination variations

B) **Linear Discriminant Analysis (LDA)** :- The purpose of discriminant analysis is to classify objects i.e. people, customers, things, etc. into one of two or more groups based on a set of features that describe the objects e.g. gender, age, income, weight, preference score, etc. If one can assume that the groups are linearly separable, one can use linear discriminant model (LDA). Linearly separable suggests that the groups can be separated by a linear combination of features that describe the objects. If only two features, the separators between objects group will become lines. If the number of features is three, the separator is a plane and if the number of features i.e. independent variables is greater than three, the separators become a hyper-plane .

Methodology : The steps in LDA are as follows:-

Samples for class1 and class2 . Calculate the mean of class1 and class2 i.e. Mu1 and Mu2

Covariance Matrix of the first class and second class i.e. S1 and S2

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Calculate within-class scatter matrix by using given equation
Sw = S1 + S2

Calculate between-class scatter matrix by using given equation
SB = (Mu1-Mu2)*(Mu1-Mu2)

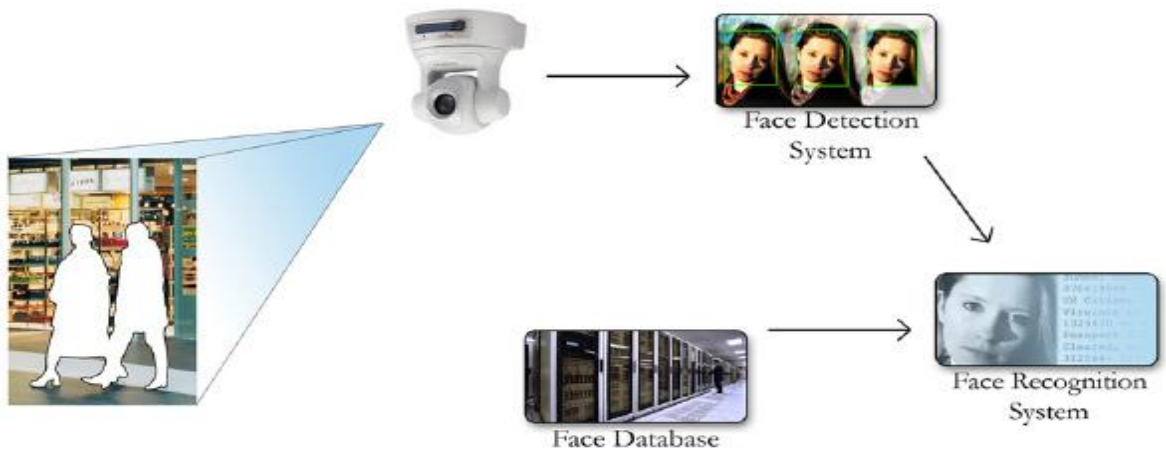
Calculate the mean of all classes

The LDA projection is then obtained as the solution of the generalized eigenvalue problem

$Sw^{-1}S_BW=\lambda w$

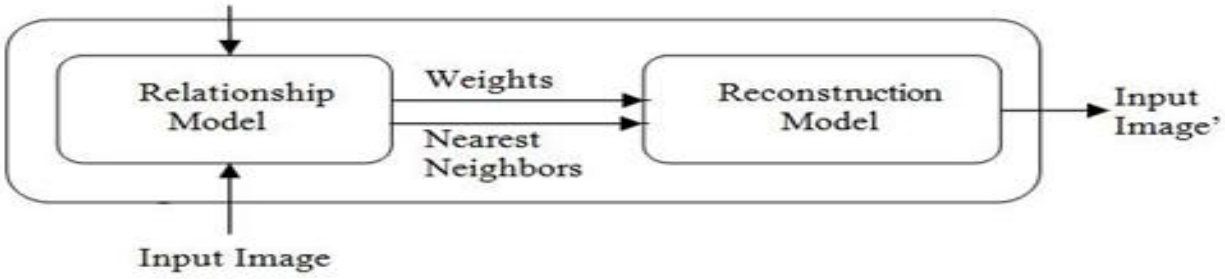
$w=eig(Sw^{-1}sb)$

VI. DIAGRAMS OF FACE RECOGNITION



VII PROPOSED METHOD

We propose a robust mathematical model for representing complex manifolds formed by face/object images and a method to map test images to these manifolds.



VIII. RESULTS

The method was tested and evaluated for face recognition. The results show that the proposed method is superior to other state of the art methods.

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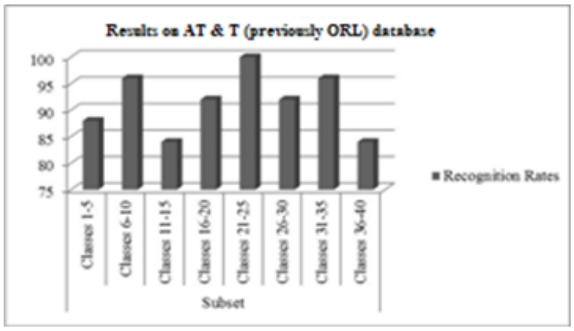

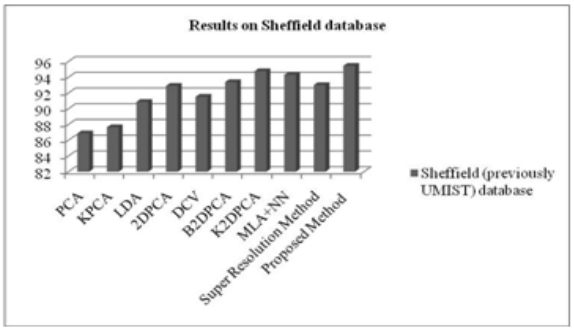

IX. CONCLUSION

This paper work addressed the problem of face and hand interaction in certain hand gestures of ISL.The occlusion problem is efficiently eliminated and the recognition rate has been increased prominently with the help of additional face position information given by the four quadrant concept of our work. In future more real conversation ISL videos will be analyzed and the shadow occlusion problem. A face recognition system must be able to recognize a face in many different imaging situations. It will find faces efficiently without exhaustively searching the image. Face recognition systems are going to have widespread application in smart environments.

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