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Person Identification using Face Modality

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ABSTRACT

Face recognition assignment is a very popular task used not only in government sector but also all private sectors applied it for security purpose, Biometrics technique plays main role in this field. Many physiological and behavioral characteristics can be chosen for the person identification.

In this paper I work on a single biometric modality face. Apply principal component analysis neural network classifier for calculating matching score Result shows better performance. all work performed on self created database of 100 parson face.

Keywords

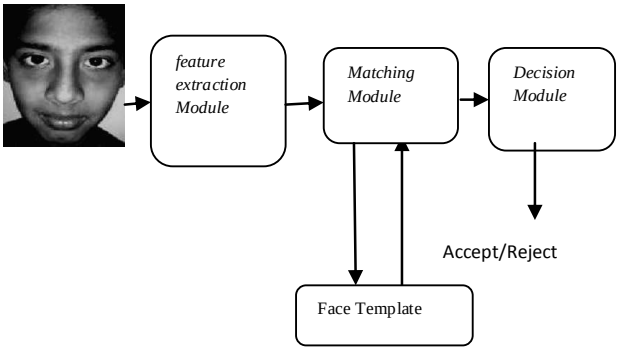
Biometrics, Principal component analysis (PCA), eigen images, Euclidian distance.

INTRODUCTION

Biometrics provide the facilities of person identification and verification. Many biometrics such as finger print, iris, voice and signature are used for this purpose. Fingerprint(Thumb) is one of the application which is used in many areas like examination verification, attendance of employee and registry office. Now a days face identification is most applicable for person authentication. Face recognition technique is a process of recognizing a person based on features extracted from the face of the person. This is an application of computer for automatic identification or verification of a person using digital image or a video frame captured. This type of biometric system is most commonly used. Face recognition methods are various types using facial metrics and Eigen faces. Facial metric method relies on the specific facial features such as positioning of eyes, nose and mouth and distance between these features; whereas the Eigen face method is based on differentiating faces according to the degree of it with a fixed set of 100 to 150 Eigen faces.

In this paper I proposed Principle Component Analysis based on neural network classifier is to obtain the features by input face images decision is made by matching the test image with the images registered in the database. Section 2 describes related research in this field. Section 3 gives description of Identification process. Section 4 Explain the method which is applied to the modalities. Section 5 Show Experimental results and conclusion has been discussed.

Figure 1 shows the biometric system.



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RELATED RESEARCH

Since 1954 many researches contributed several approaches in this field. Bruner et al. (1954) started to analyse faces to distinguish them in order to conduct psychological research. However, the research on automatic machine recognition of faces could start in the 1970s. Chellappa et al. (1995) did extensive research with the help of psychologists, neuroscientists and engineers on various aspects of face recognition by humans and machines. The early face recognition was mainly based on measured facial attributes such as eyes, eyebrows, nose, lips, chin shape etc.

Hong et al. (1998) opined that the lack of appropriate resources, particularly suitable algorithms, as the obstruction to achieve satisfactory performance from a face-based biometric system. Face recognition algorithms can be divided into three categories: holistic methods, which use the whole face image for recognition; feature-based methods, which use local regions such as eyes or mouth; and hybrid methods, which use both local regions and the whole face. Turk et al. (1991) used PCA for face recognition using Eigen space decomposition. The faces were compared using a Euclidean distance measure by projecting them into Eigen face components and results were provided for a 16-users database of 2500 images in various conditions. Belhumeur et al.(1997) proposed a face recognition algorithm, known as Fisher face using both PCA and FLDA (Fisher's Linear Discriminant Analysis) methods to overcome the problem of illumination and pose variations. Wiskott et al. (1997) studied deformations of the faces using local features (chin, eyes, nose, etc.) represented by wavelets and computed from different face images of the same subject. Huang et al. (2003) developed a hybrid face recognition system where a combination of component-based recognition and 3D morphable models were used for pose and illumination invariant face recognition.

FACE RECOGNITION

31. Enrolment

The enrolment is very important process involved in biometrics. This is illustrated in Fig. 2 and Fig.3 shows cropped and resized image of face. The steps of biometric trait enrolment are:

- The biometric data or input is captured using suitable acquisition system or sensor.
- The modality is stored inside the biometric database.
- Features are extracted from the traits and converted into suitable transformations, called as biometric templates.

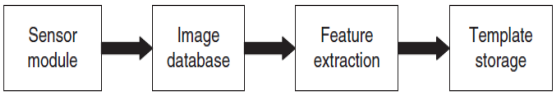

Fig.2: Enrollment Process.

Fig.3 Face image

3.2Training and Testing Process

Biometric system is divided into two major processes namely training and testing. During training process, biometric modality is captured and converted into suitable template. This process is performed as:

- Input image or signal is captured or acquired.
- The signal is pre-processed to remove noise or some similar signal; or image resizing, reformatting takes place.
- Feature extraction is performed.
- Features are transformed into suitable templates and these are stored in template database.

Testing process is performed at the time of matching, which is similar to training method. The input is captured and it is subjected to:

- Pre-processing.
- Feature extraction.
- Template conversion.

The template is matched against the templates already present in the template databases. If there is matching, it results matching of the input. The training and testing processes are illustrated in Fig. 4 respectively..

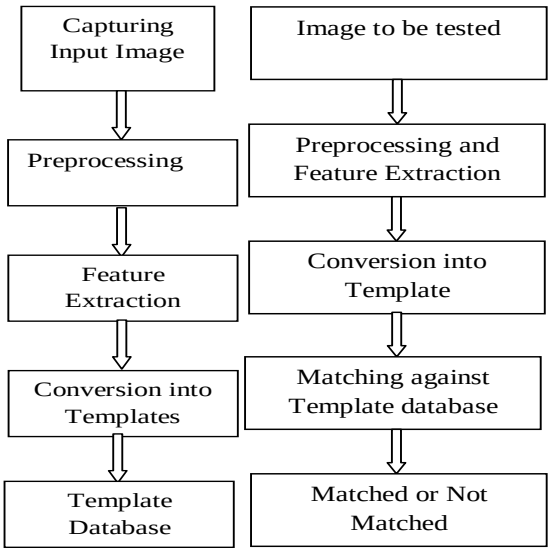

Fig.4: Training and Testing process in biometrics

METHEDOLOGY

Principal Component Analysis

Person recognition algorithms are Principal Component Analysis (PCA). The main idea is to de-correlate data in order to highlight differences and similarities by finding the principal directions (i.e. the eigenvectors) of the covariance matrix of a multidimensional data. For testing the biometric system, face images were used from the training set of face images. Before going to next step first train the PCA using the training set of images, The mean image is computed of the training data as:

$$\psi_{Train} = \frac{1}{M}\sum_{n-1}^{M}\Gamma_n \qquad (1)$$

Each training image is subtracted by mean image as:

$$\phi_i = \Gamma_i - \psi_{Train} \quad i = 1,2,\ldots..M \qquad (2)$$

It is large vectors set subjected to PCA which seeks a set of M ortho-normal vectors, U_n. The k^{th} vector, U_k, is chosen such that:

$$\lambda_K = \frac{1}{M}\sum_{n-1}^{M}(U_k^T \Phi_n)^2 \qquad (3)$$

The vectors U_k and scalars λ_k are the eigenvectors and Eigen values respectively of the following covariance matrix (CM):

$$C = \frac{1}{M}\sum_{n-1}^{M}(\Phi_n \Phi_n{}^T) = AA^T \quad (4)$$

The mean image Ψ of the gallery set is computed. This is projected onto the "face space" by the M Eigen vectors derived from the training set. This gives:

$$\omega_K = U_K^T \Phi_i \quad K = 1 \ldots. M \qquad (5)$$

Euclidian distance is calculated for face as follows:

$$d_K = \| \Omega - \Omega_k \| \qquad (6)$$

EXPERIMENTAL OUTCOME

Each image in the training set is transformed into the image space and its components are stored in memory. An input face is subjected to the system and projected onto the face space. Then Euclidian distance is computed.
A database is created that consists of 100 person's images. In which I take face images. first all image converts RGB to gray scale and resize After that I applied PCA classifier for face image Figure 5 to 10 shows the experimental results using MATLAB software

Figure 5 to Figure 10 present results for face images

Fig 5: Training set of face images

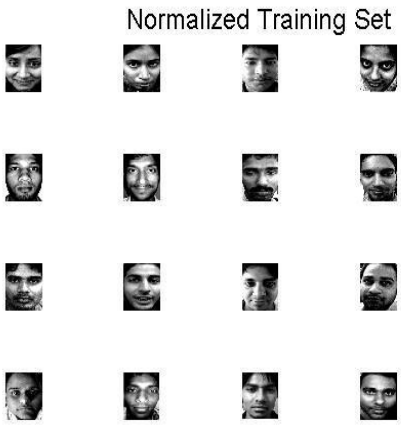

Fig 6: Normalized Training set of faces.

Fig. 7: Mean image

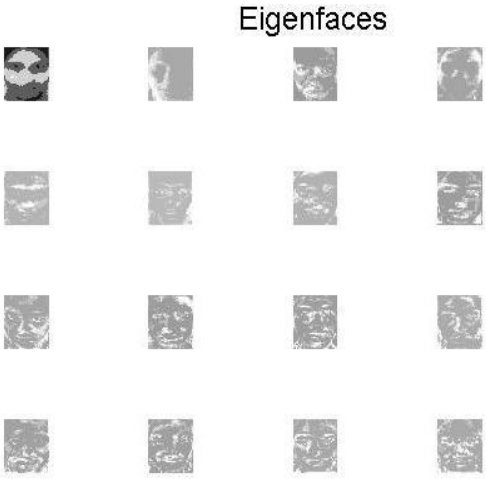

Fig. 8: Eigen faces

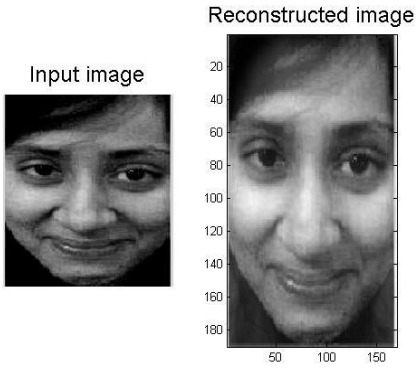

Fig. 9: Input image and reconstructed image

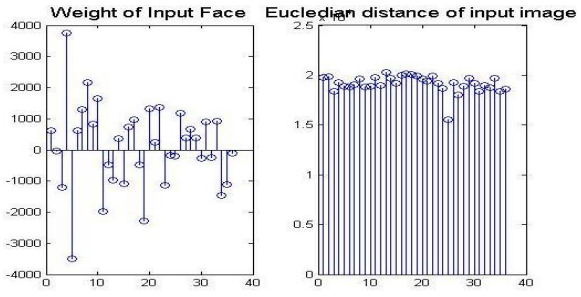

Fig. 10: Weight of input face and the Euclidian distance.

RESULTS

MATLAB software is used to calculate results. Shown in previous the minimum-distance is calculated by Euclidian distance for face shown in Table 1

Table 1 : Euclidian distance for Faces

Faces	Minimum Euclidian distance for faces
Pf1	1.5488E+04
Pf2	1.5485E+04
Pf3	1.5483E+04
Pf4	1.5470E+04
Pf5	1.5488E+04
Pf6	1.5495E+04
Pf7	1.5492E+04
Pf8	1.5515E+04
Pf9	1.5496E+04
Pf10	1.5502E+04
Pf11	1.5504E+04

Table 2: Individual Trait Face

Trait	Genuine Score	Imposter Score	Threshold Value
Face	1.5470E+04	1.8119E+04	1.5510E+04
Trait	**FAR**	**FRR**	
Faces	1.1682E+00	9.9742E-01	

Face images are tested individually and the results of individual modalities are calculated in term of genuine score, imposter score, Threshold value, FAR and FRR shown in Table 2 and Table 3 shows weight, EER and normalized score

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Traits	Weight	EER	Normalized Score
Faces	0.85	1.171	0.35

CONCLUSIONS

Many researchers gave their contributions in the biometric system field. They applied different approaches for finding the results of face. But PCA approach gives the better result for face. All work is performed on self created database using MATLAB software.

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