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A REVIEW ON VARIOUS APPROACHES OF FACE RECOGNITION BASED ON SHAPE AND TEXTURE FEATURES

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ABSTRACT

Face recognition has been an area of research from last two decades, due to changes in human faces and effects of lightening and age on face images appropriate approaches must be presented that provides better accuracy. In this paper various approaches of face recognition has been discussed. These approaches have been used for face recognition under the area of appearance and texture based recognition process. In this paper various effects that degrade performance of the previous approaches have been discussed and techniques that overcome these effects of face recognition have been illustrated.

Keywords: Biometric, Face, Finger, Iris, Palm, PCA, EULBP.

I. INTRODUCTION

1.1 Biometrics

A brief establishment of biometric and biometric security structures will give a more conspicuous cognizance of the thought of framework security. Biometrics is portrayed as the exceptional (individual) physical/wise properties or attributes of human body. These qualities and attributes are used to perceive each human. Any purposes of enthusiasm of the human body which changes from one human to other will be used as remarkable biometric data to serve as that individual's momentous (ID, for instance, retinal, iris, interesting finger impression, and palm print and DNA. Biometric structures will accumulate and store this data with a particular deciding objective to use it for checking individual identity. The mix of biometric data systems and biometrics affirmation/ ID advances makes the biometric security structures. Biometric security system is a lock and catch framework to control access to specific data. To get to the biometric security system, an individual will need to give their phenomenal qualities or properties which will be composed to a database in the structure.

1.2 Biometric Modalities

Biometric modality refers to a system built to recognize a particular biometric trait. Face, fingerprint, hand geometry, palm print, iris, voice, signature, gait, and keystroke dynamics are examples of commonly used biometric traits.

1.2.1 Face

Face recognition is a non-nosy technique, and facial pictures are most likely the most widely recognized biometric trademark utilized by people to make an individual recognition. Static or video images of a face can be used to facilitate recognition. Modern approaches are only indirectly based on the location, shape, and spatial relationships of facial landmarks such as eyes, nose, lips, and chin, and so on.

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1.2.2 Fingerprint

the patterns of ridges and valleys on the "friction ridge" surfaces of fingers—have been used in forensic applications for over a century. Friction ridges are formed in utero during fatal development, and even identical twins do not have the same fingerprints. The recognition performance of currently available fingerprint-based recognition systems using prints from multiple fingers is quite good. One factor in recognition accuracy is whether a single print is used or whether multiple or ten prints are used.

1.2.3 Palm print Identification System

Palm print based individual check has immediately entered the biometric family because of its simplicity of obtaining, high client acknowledgement and unwavering quality. Palmprint not just has the interesting data accessible as on the unique finger impression yet has significantly more measure of subtle elements regarding main lines, wrinkles and creases.

1.2.4 Iris

We are living in the age, in which the demand on security is increasing greatly. Consequently, biometric recognition, which is a safe, reliable and convenient technology for personal recognition, appears. Iris recognition is the procedure of perceiving an individual by dissecting the irregular example of the iris. The computerized system for iris recognition is generally youthful, existing in patent since just 1994. The iris is a muscle inside the eye that directs the extent of the student, controlling the measure of light that enters the eye.

1.2.5 Speech

Speech is a combination of both physical and behavioral biometrics traits. The features of an individual's voice are based on the shape and size of the appendages (e.g., vocal tracts, mouth, nasal cavities, and lips) that are used in the synthesis of the sound. Physical characteristics of behavior part of speech change with the age, because of some medical conditions such as cold etc. A text-dependent voice recognition system is based on the utterance of a fixed predetermined phrase i.e. password.

II. REVIEW OF LITERATURE

Changxing Ding, et al [1] explained that to perform unconstrained face recognition robust to variations in illumination, pose and expression, this paper presents a new scheme to extract "Multi-Directional Multi-Level Dual-Cross Patterns" (MDML-DCPs) from face images. Specifically, the MDML-DCPs scheme exploits the first derivative of Gaussian operator to reduce the impact of differences in illumination and then computes the DCP feature at both the holistic and component levels.

Kyungnam Kim [2] proposed a technique PCA for face recognition. The Principal Component Analysis (PCA) is one of the most successful techniques that have been used in image recognition and compression. This is the case when there is a strong correlation between observed variables. The jobs which PCA can do are prediction, redundancy removal, feature extraction, data compression, etc., Because PCA is a classical technique which can do something in the linear domain. Face recognition has many applicable areas. Moreover, it can be categorized into face identification, face classification, or sex determination. The most useful applications contain crowd surveillance, video content indexing, personal identification (ex. driver's licence), mug shots matching, entrance security, etc. The main idea of using PCA for face recognition is to express the large 1-D vector of pixels constructed from 2-D facial image into the compact principal

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components of the feature space. This can be called Eigen space projection. Eigen space is calculated by identifying the eigenvectors of the covariance matrix derived from a set of facial images (vectors).

Pong C. Yuen, J.H. Lai [3] proposed the problem of face recognition using independent component analysis (ICA). More speci1cally, we are going to address two issues on face representation using ICA. First, as the independent components (ICs) are independent but not orthogonal, images outside a training set cannot be projected into these basis functions directly. In this paper, we propose a least-squares solution method using Householder Transformation to 1nda new representation. Second, we demonstrate that not all ICs are useful for recognition. Along this direction, we design and develop an IC selection algorithm to 1nda subset of ICs for recognition. Three public available databases, namely, MIT AI Laboratory, Yale University and Olivette Research Laboratory, are selected to evaluate the performance and the results are encouraging.

JianYang, David Zhang, Alejandro F. Frangi, and Jing-yu Yang [4] proposed a new technique 2DPCA for image representation. Opposed to PCA, 2DPCA is based on 2D image matrices rather than 1D vector so the image matrix does not need to be transformed into vector prior to feature extraction. A covariance matrix is constructed directly using the original image matrices and its eigenvectors are derived for image feature extraction .the 2DPCA techniques is applied on the ORL, AR and YALE databases. It shows the recognition rate and recognition accuracy is always higher than that of the PCA .there is one drawback with respect to PCA that is it need more coefficients for image representation.2DPCA approach is suitable for the small sample size problems.

Timo Ahomen, Abdenour Hadid and Matti Pietikainen [5] proposed a new approach for image representation by using the LBP (local binary pattern). The face image is divided into several regions from which the LBP feature distribution are extracted and concatenated into an enhanced feature vector to be used as face descriptor .the performance of proposed method is assessed in the face recognition problem under the different challenges.

Niloofar Amani1, AsadollahShahbahrami and Manoochehr Nahvi1 [6] proposed a new approach to improve the face recognition accuracy. This approach is based on the contrast enhancement using high-frequency emphasize filtering and histogram. In this method image contrast and the global (or local) visualization are enhanced using digital filtering and equalizing the histogram of the pixel values over entire image. For this, first the face images are transformed into a high-frequency domain and then the global thresholding technique, by Otsu method, is applied to the image. Then, the values lower than threshold has only been considered. For dimension reduction and also feature extraction purpose the linear method such as two dimensional principle component analysis (2DPCA) and two dimensional linear discriminate analysis (2DLDA) are adopted. In the last stage of the algorithm, the simple minimum distance method is exploited for the classification.

III. APPROACHES USED

3.1 Principal Component Analysis (PCA)

PCA was invented by Karl Pearson for reduction of dimensions of the dataset that contain redundant information. This leads to reduction in variables from dataset that known as principal components from the dataset which accounts most variation occurred in different variables of dataset. Eigen faces are the principal components from the distribution of the faces or Eigen vectors are the 2-dimessional feature subspace from

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N*N covariance image of facial part. Each face image is a linear combination of different face images in Eigen sub space. Eigen face cosmists mean of all the images that are available in the dataset images that has been used for matching process. Eigen values of query image have been matched with dataset Eigen values for recognition process.

In this process of Eigen face mean image has been computed from all the images available in the dataset that has been represented by X1, X2…….Xn.

$$\Psi = \frac{1}{N}\sum_{i=1}^{N} X_i \qquad (1)$$

After computation of mean image dataset images subtracted image has been reconstituted for the images that has been used for development of covariance matrix.

$$\Phi = X - \Psi \qquad (2)$$

Eq. (2) represents subtracted image the group of images have been used for reconstructions of facial images covariance matrix

$$M=A.A^T \qquad (3)$$

Fig. 3 training dataset images

After this process the Eigen features and the Eigen values for the face image was computed The Eigen value μ_i and Eigen vector v_i has been computed on the basis different equations that are represented as.

$$M.v_i=\mu_i.v_i \qquad (4)$$

Fig. 4 Mean image constructed from dataset images

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By using the Eigen values and Eigen vectors Eigen face matrix has been generated that is used as features for matching purposes.

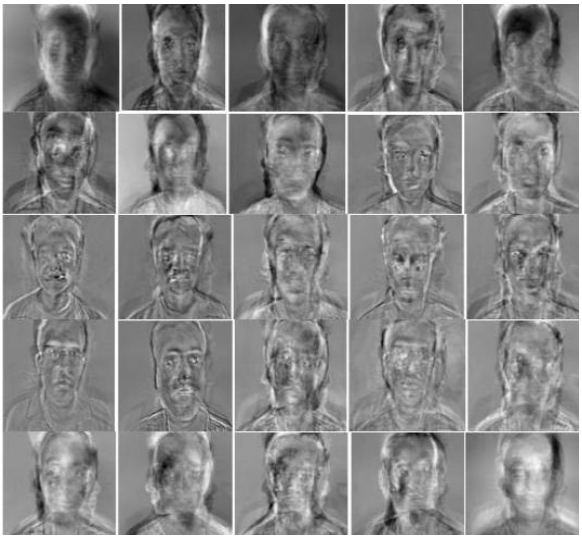

Fig. 5 Eigen faces from all images

After the generation of Eigen space, the matrix is computed by using different face samples. The database features has been stored. These feature sub spaces have been used for recognition purpose using distance classifier represented in eq. (5)

$$d = \sum_{i=1}^{N} |x_I - y_i| \quad (5)$$

3.2 Independent Component Analysis

ICA is very closely related to the method called blind source separation (BSS) or blind signal separation. A "source" means here an original signal, i.e. independent component, like the speaker in a cocktail party problem. "Blind" means that knows very little, if anything, on the mixing matrix, and makes little assumptions on the source signals. ICA is one method, perhaps the most widely used, for performing blind source separation. In many applications, it would be more realistic to assume that there is some noise in the measurements which would mean adding a noise term in the model. For simplicity, we omit any noise terms, since the estimation of the noise-free model is difficult enough in itself, and seems to be sufficient for many applications.

Discrete Cosine Transform: A discrete cosine transform (DCT) expresses a finite sequence of data points in terms of a sum of cosine functions oscillating at different frequencies. DCTs are important to numerous applications in science and engineering, from lossy compression of audio and images to spectral methods for the numerical solution of partial differential equations. The use of cosine rather than sine functions is critical for compression, since it turns out that fewer cosine functions are needed to approximate a typical signal, whereas for differential equations the cosines express a particular choice of boundary conditions.

3.3 EULBP

This approach has been used in number of different applications that includes tasks related to face detection, face recognition, demographic classification and facial expression analysis. In addition to LBP, EULBP is one of extension of this approach. In EULBP, dimensions of histograms are reduced by doubling one- dimensional pattern. It takes the effect of central pixels that improves the discrimination ability. LTP is other type of LBP

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which is more resistant to noise. In LTP, ternary code is developed and they are divided into upper binary and lower binary pattern. LTP include pre-processing, thresholding, local histograms.

IV. CONCLUSION

In this paper various approaches of face recognition has been studied that has been used for face detection and recognition process. Face plays an important role in human identification as well as matching process. In this paper various approaches that are texture based, Eigen value based and transformation based. On the basis of analysis of different approaches that has been used for biometric identification process EULBP consist of lower feature dimensions that cause less time complexity and provides better accuracy, whereas in texture based face recognition EULBP is much better than other approaches because prone to noise, and uniform regions.

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