International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 11
July2016

A Review on various approaches of face features extractions

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Abstract- Face Recognition based on Euclidean distance and texture feature. A method for Face Recognition by using the GLCM (Gray Level Co-occurrence Matrix) and texture features. Euclidean distance classifier is used for the matching between the training and testing images. In this paper we are studied various approaches or existing techniques. In this paper all are defined there.

Keywords: DWT and DCT and ELTP approach, False Acceptance Rate and False Rejection Rate, EULBP.

1 INTRODUCTION

1.1 Introduction to Biometric:

The field of biometrics examines the unique physical or behavioural traits that can be used to determine a person's identity. Biometric recognition is the automatic recognition of a person based on one or more of these traits. The word "biometrics" is also used to denote biometric recognition methods.

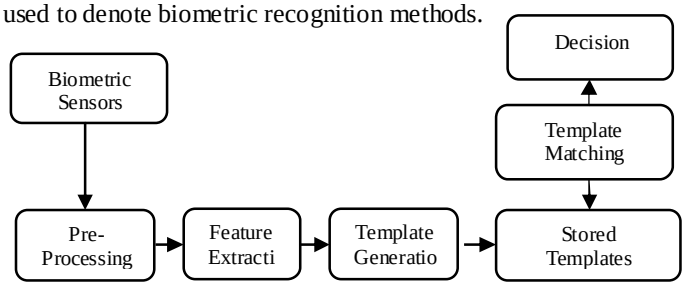

Figure 1.1 Components of Biometrics system

1.2 Biometric Characteristics:

- Face
- Gait
- Voice
- Hand Geometry
- Fingerprint

1.3 Challenges In Face Recognition

- **Scale:** The scale of a face can be handled by a rescaling process. In Eigen face approach, the scaling factor can be determined by multiple trials. The idea is to use multi scale Eigen faces, in which a test face image is compared with Eigen faces at a number of scales. In this case, the image will appear to be near face space of only the closest scaled Eigen faces. Equivalently, we can scale the test image to multiple sizes and use the scaling factor that results in the smallest distance to face space.
- **Variation in Poses:** Varying poses result from the change of viewpoint or head orientation. Different identification algorithms illustrate different sensitivities to pose variation.
- **Variation in I luminance:** To identify faces in different luminance conditions is a challenging problem for Face Recognition. The same person, with the same facial expression, and seen from the same viewpoint, can appear dramatically different as lighting condition changes. In recent years, two approaches, the fisher face space approach and the illumination subspace approach, have been proposed to handle different lighting conditions. The fisher face method projects face images onto a three-dimensional linear subspace based on Fisher's Linear Discriminant in an effort to maximize between-class scatter while minimize within-class scatter. The illumination subspace method constructs an illumination cone of a face from a set of images taken under unknown lighting conditions. This latter approach is reported to perform significantly better especially for extreme illumination.

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- **Facial Expression:** Different from the effect of scale, pose, and illumination, facial expression can greatly change the geometry of a face. Attempts have been made in computer graphics to model the facial expressions from a muscular point of view.

- **Disguise:** Disguise is another problem encountered by Face Recognition in practice. Glasses, hairstyle, and makeup all change the appearance of a face. Most research work so far has only addressed the problem of glasses.

1.4 Face Recognition scenarios can be classified into two types

Face Recognition scenario has been classified into two different categories. These categories are basically matching of face image with single image or group of images. these two scenario of Face Recognition has been explained below.

1.4.1 Face verification (or authentication)

Face verification is the process to verify person's identity that has been claimed to be matched with template. Face verification is the process of one to one match that comparing a query face with claiming face. Verification is to be done on the basis of features of template image and query image. to evaluate performance of the face verification different parameters have to be classified that has been used for different ROC curves. False acceptance and false rejection rate has to be computed to compute verification rate of the claimed query. A good verification system should balance these two rates based on operational needs.

1.4.2 Face identification (or recognition)

Face identification is the process of matching of single person image with multiple images available in the database. This face identification process is also known as one too many matching process. In this process query face image is compared with all the template images available in the face image database. The image that is closest match with the database images is most identifying image that match with test image. The query face image features has been compared with the database face images so that can identify that maximum matched image on the basis of distance. The distance has been computed with all the images available in the database of facial images. These distances have been arranged numerically in ascending order. The top level image distance is maximum matched image with the test image available in the database. If the top arranged distance is minimum then that define maximum matched image has been found with test image. On the basis of these test results the parameters for Face Recognition system. False Acceptance Rate (FAR) and False Rejection Rate (FRR) had to be computed for performance evolution of face identification system.

2 REVIEW OF LITERATURE

Kyungnam Kim "Face Recognition using Principle Component Analysis**" [**1**]** in this paper author proposed a technique Principal Component Analysis for Face Recognition. Principal Component Analysis was one of the most successful techniques that have been used for feature extraction from face image recognition. PCA utilized the one dimensional vector for the development of co-variance matrix. PCA was a statistical method to reduce the large dimensionality of features sub spaces. In the Face Recognition the principal component analysis describe the co-variance matrix. That co-variance matrix is used to develop Eigen values for the feature vector. That Eigen values were used for the development of eigen faces. On the basis of that Eigen face the Face Recognition was done by computing distance between query image Eigen face and database images eigenfaces. The Eigen face is also known as feature space for Face Recognition. PCA can be used in various problems occurred in the computer applications that are prediction, redundancy removal, feature extraction, data compression, etc.

Pong C. Yuen, J.H. Lai "Face representation using independent component analysis" [2]In this paper author purposed an approach independent component analysis that was used for Face Recognition, Face Recognition has been done on the basis of features computed by independent component analysis. Independent component analysis computed different independent features for the facial image. The major issues in the independent component analysis are that the components are independent but not all the components are orthogonal so that image which does not belongs to training dataset that can't be recognised by using independent component analysis approach. This paper purposed approaches that use least square solution that computes Householder Transformation to 1-dimenssional feature vector.

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Another issue in the ICA approach is that all the independent components are essential for Face Recognition. This approach is implemented on various datasets available for Face Recognition for performance evolution.

JianYang, David Zhang,Alejandro F. Frangi, and Jing-yu Yang "Two Dimensional PCA: A New Approach to Appearance base face representation and Recognition" [3] in this paper author purposed a new technique 2-Dimensional Principal Component Analysis for facial image description. 2DPCA is mainly based on different 2-D image matrices that are required for feature extraction rather than that require 1-D in principal component analysis. From 2D metrics of the image covariance matrix has to be derived so that the Eigen values can be computed and used for feature extraction on the basis of those Eigen values. These Eigen values are used for construction of Eigen faces. Eigen faces are the basic features of facial image. 2DPCA technique is applied on different face image databases. Performance of purposed approach is always better than that of PCA in terms of accuracy. There is one drawback with respect to PCA that is it needs more coefficients for image representation.2DPCA approach is suitable for the small sample size problems.

TimoAhomen, AbdenourHadid and MattiPietikainen"Face Description with Local Binary Patterns: Application to Face Recognition" [4]purposed a new approach for image representation by using the LBP (local binary pattern). The face image is divided into several regions. On each region of the face image a 3*3 mask in applied that computes the binary patterns for each divided region. These binary patterns are concatenate to derive face descriptor. That face descriptor is the face feature that is known as texture features of facial image. This approach is mainly used for gray scale facial images. In this paper the accuracy of LBP for different dataset has been discussed.

Niloofar Amani1, AsadollahShahbahrami and ManoochehrNahvi"A new approach for face image enhancement and recognition" [5]in this paper author purposed an approach that has been used for Face Recognition on the basis of histogram features. 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.

Dong-Ju Kim, Sang-Heon Lee and Myoung-KyuSohn "Face Recognition with Local Directional Patterns" [6] proposes an illumination-robust Face Recognition system via local directional pattern images. Usually, local pattern descriptors including local binary pattern and local directional pattern have been used in the field of the Face Recognition and facial expression recognition, since local pattern descriptors have important properties to be robust against the illumination changes and computational simplicity. Thus, this paper represents the Face Recognition approach that employs the local directional pattern descriptor and two-dimensional principal analysis algorithms to achieve enhanced recognition accuracy. In particular, we propose a novel methodology that utilizes the transformed image obtained from local directional pattern descriptor as the direct input image of two-dimensional principal analysis algorithms, unlike that most of previous works employed the local pattern descriptors to acquire the histogram features. The performance evaluation of proposed system was performed using well-known approaches such as principal component analysis and Gabor-wavelets based on local binary pattern, and publicly available databases including the Yale B database and the CMU-PIE database were employed. Through experimental results, the proposed system showed the best recognition accuracy compared to different approaches, and we confirmed the effectiveness of the proposed method under varying lighting conditions. This algorithm can be implemented on the high resolution database only to get the optimum recognition accuracy and low FAR and High FRR.

3 APPROACHES USED

3.1 Principal component analysis (PCA)

PCA is mostly used as a tool in exploratory data analysis and for making predictive models. PCA can

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be done by eigenvalue decomposition of a data covariance (or correlation) matrix or singular value decomposition of a data matrix, usually after mean centering (and normalizing or using Z-scores) the data matrix for each attribute.[4] The results of a PCA are usually discussed in terms of component scores, sometimes called factor scores (the transformed variable values corresponding to a particular data point), and loadings (the weight by which each standardized original variable should be multiplied to get the component score).

PCA is the simplest of the true eigenvector-based multivariate analyses. Often, its operation can be thought of as revealing the internal structure of the data in a way that best explains the variance in the data. If a multivariate dataset is visualized as a set of coordinates in a high-dimensional data space (1 axis per variable), PCA can supply the user with a lower-dimensional picture, a projection or "shadow" of this object when viewed from its (in some sense; see below) most informative viewpoint. This is done by using only the first few principal components so that the dimensionality of the transformed data is reduced.

3.2 2DPCA:

In the Eigenfaces method, the principal components and eigenvectors (eigenfaces) can be combined to reconstruct the image of a face. Similarly, 2DPCA can be used to reconstruct a face image in the following way. Suppose the orthonormal eigenvectors corresponding to the first d largest eigenvectors of the image covariance matrix Gt are After the image samples are projected onto these axes, the resulting principal component vectors.

3.3 2-Dimensional LDA

The key difference between classical LDA and the 2DLDA that we propose in this paper is in the representation of data. While classical LDA uses the vectorized representation, 2DLDA works with data in matrix representation. We will see later in this section that the matrix representation in 2DLDA leads to an eigendecomposition on matrices with much smaller sizes. More specifically, 2DLDA involves the eigen-decomposition of matrices with sizes r×r and c×c, which are much smaller than the matrices in classical LDA. This dramatically reduces the time and space complexities of 2DLDA over LDA.

3.4 Local Binary Pattern

(LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number. Due to its discriminative power and computational simplicity, LBP texture operator has become a popular approach in various applications. It can be seen as a unifying approach to the traditionally divergent statistical and structural models of texture analysis. Perhaps the most important property of the LBP operator in real-world applications is its robustness to monotonic gray-scale changes caused, for example, by illumination variations. Another important property is its computational simplicity, which makes it possible to analyze images in challenging real-time settings.

CONCLUSION

Texture features are particularly susceptible to the resolution of images, when the resolution changes the calculated textures are not accurate. Texture features calculated by the GLCM is not adaptive for low resolution images or blurred images. For blurred images this method achieves poor accuracy.
The purpose of the research is to improve the accuracy for the low resolution images. By analysing various approaches for Face Recognition there is need to develop a new approach which can provide better results using texture features for blurred images.

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