A Scenario of Biometric Recognition System for Image Identification Using PCA

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***Abstract*- In this paper to recognize the face or image through Principal Component Analysis (PCA) methid. It is a way to read an image or pattern from database and match quickly and produce the result. The principal component analysis is used for feature extraction and Eigen face algorithm for pattern matching. It is an useful technique to reduce the dimensionality of the datasets for compression and recognition purposes. Through this, image identified in data and express the data in such a way as to highlight their similarities and differences. The representation produced during tests are commonly called eigenvectors and in the context of face recognition.**

***Index Terms*- PCA, Eigen face Algorithm, Pattern matching, Eigen vector.**

I. INTRODUCTION

To develop an efficient "Human Face Recognition System using Eigen Face approach". This system is meant for recognizing human faces from a set of images out of a large database containing many images per person. This project will use Principal Component Analysis for recognition purpose. Also changing lighting conditions causes relatively few errors, while performance or accuracy varies with size variation. Threshold value should be as low as possible to automatically discard low confidence results because if we increase the threshold value accuracy decreases for unknown faces. The presence or absence of structural components can affect the efficiency of the system. Using the reduced subspace, computations on the database become more efficient. The representation produced are commonly called eigenvectors and in the context of face recognition, Eigen faces[1].

II. BACKGROUND

The modern rapid advancements in increased the need of reliable ways to verify the identity of any person. As organizations search for more secure authentication methods for user access, e-commerce, and other security applications, biometrics is gaining increasing attention. Use of biometrics like face image, fingerprints, and iris image for identity recognition is more attractive since biometrics are integral to a person. Biometrics is the study of methods for uniquely recognizing humans based upon one or more intrinsic physical or behavioural traits. This project system is meant for recognizing human faces from a set of images out of a large database containing many images per person[2]. It can be used for building a security system based on face authentication. Face recognition technology provides an automated way to search, identify or match a human face versus the contents of a pre-stored facial database.

III. HOW BIOMETRIC SYSTEM WORKS?

Most of the organizations, hospitals, govt. offices, college , universities hotel. Every where biometric machine are using, as shown in fig1.

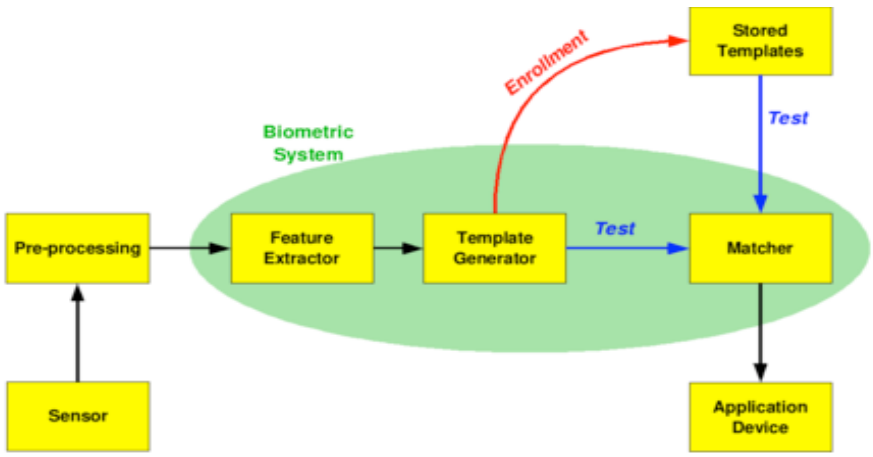

Fig1. Basic Biometric System

All biometric systems operate in a similar fashion. The basic premise of biometrics is - that a person has a sample of their biometric data captured and the biometric system decides if it matches with another sample[3].
The following points illustrate the way biometric systems operate:

- First, the system captures a sample of the biometric characteristics[4]. This is known as the enrolment process. During enrolment, some biometric systems may require a number of samples in order to build a profile of the biometric characteristic.
- Now all the necessary pre-processing is performed e.g. to enhance the input (removing some noise), to use some kind of normalization, etc. Unique features are then extracted that are used to create a template.
- A template is a synthesis of all the characteristics we could extract from the source, it has to be as short as possible (to improve efficiency) but we can't discard too many details, thus losing discrimination ability.

Now, if system is performing enrolment, then the template can simply stored on a computer database, smart card or barcode. If it is performing the matching phase, the obtained template is passed to a matcher that compares it[5].

- With other existing templates, estimating the distance between them using any algorithm.
- The decision that the matcher has taken is sent as output, so that it can be used for any purpose. (E.g. it can allow a purchase or the entrance in a restricted area).
- The biometric system may require a trigger, or a means of matching the template to the person, for e.g. a PIN is keyed-in to access the template, or a smart card storing the template is inserted into a card reader. In either case, the end user interacts with the biometric system for a second time to have his or her identity checked. A new biometric sample is then taken and this is compared with the template. If the template and the new sample match, the end user is granted access.

IV. WORK FLOW & ALGORITHM

The flow of identification is, firstly image upload as an input, view and match the image than conversion into binary form and apply pca to get desired output[6][7].

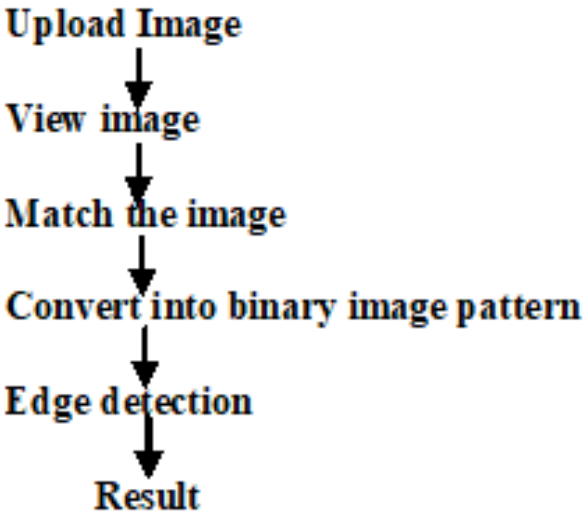

Fig2. Image Identification Flow

Algorithm:

Step1: create database
Step2: calculate Eigen face
Step3: browse the image
Step4: Apply Euclidean distance theorem.
Step5: now measure distance of points on face.
Step6: PCA algorithm
Step7: Matching the image.
Step8: Output

V. PRINCIPLE COMPONENT ANALYSIS

The principal component analysis is defined as a linear combination of optimally-weighted observed variables.
This statistical method is used to reduce the number of variables in face recognition[8].
this, every image in the training set is represented as a linear combination of weighted eigenvectors called eigenfaces. These eigenvectors are obtained from covariance matrix of a training image set. The weights are found out after selecting a set of most relevant eigenfaces.
It is a useful technique for reducing the dimensionality of datasets for compression or recognition purposes. It is a way of identifying patterns in data, and expressing the data in such a way as to highlight their similarities and differences. PCA is the optimal transform for dimension reduction as it allows correlated data in an N dimensional space to be modelled in a lower dimensional space without losing a significant amount of information. Using the reduced subspace, computations on the database become more efficient. The representation produced are commonly called eigenvectors and in the context of face recognition, Eigen faces. Starting with a collection of original face images, PCA aims to determine the principle components that best account for the distribution of a set of faces within the entire image space. These principle components are essentially

the eigenvectors of the covariance matrix of the set of images, which are termed as eigenfaces. Each individual face then can be represented exactly by a linear combination of eigenfaces or approximately by a subset of "best eigenfaces"-those that account for the most variance within the face database, characterized by its eigenvalues. An important feature of PCA is that one can reconstruct re-construct any original image from the training set by combining the eigenfaces. Eigenfaces are nothing less than characteristic features of the faces. Each eigenface represents certain features of the face, which may or may not be present in the original image. So we can say that the reconstructed original image is equal to a sum of all eigenfaces, with each eigenface having a certain weight. This weight specifies, to what degree the specific feature (Eigenface) is present in the original image[9].

Basic of algorithm: The algorithm can be classified into two category as given:

i. Database building
ii. Image recognition

Steps for database building:

- Prepare the Data set
- Calculate the eigen faces:
- Subtract the Mean
- Calculate the covariance matrix
- Calculate the eigen vectors and eigen values of covariance matrix
- Select the principal components

Steps for image recognition:

- Calculate Eigen faces of new unknown image
- Compare the faces by Euclidean distance

Feature of PCA:

- PCA is useful when we require to visualise high dimensional data.
- PCA is very simple to implement.

VI. PROS

The main advantage of biometrics in face recognition over standard systems are[10]:

- Biometric information provides extremely accurate, secured access to information.
- Fingerprints, retinal and iris scans produce absolutely unique data sets when done properly.
- Automated biometric identification can be done very rapidly and uniformly, with a minimum of training.
- Positive Identification-It identifies you and not what you have or what you carry.
- Biometric information is relatively difficult to copy, share and distribute.
- Serves as a "Key" that cannot be transferred or coerced
- Safe & user friendly.

VII. BIOMETRIC SYSTEMS CLASSIFICATIONS

Biometric identification systems can be grouped based on the main characteristic that lends itself to biometric identification[11]:

- ***Face Recognition****:* Face recognition systems work by systematically analysing specific features that are common to everyone's face - the distance between the eyes, width of the nose, position of cheekbones, jaw line, chin and so forth. These numerical quantities are then combined in a single code that uniquely identifies each person.
- ***Fingerprint****:* The Fingerprints remain constant throughout life. Fingerprint identification involves comparing the pattern of ridges and furrows on the fingertips, as well as the minutiae points (ridge characteristics that occur when a ridge splits into two, or ends) of a specimen print with a database of prints on file.
  Workstation access application area seems to be based almost exclusively on fingerprints, due to the relatively low cost, small size, and ease of integration of fingerprint authentication devices.
- ***Hand geometry****:* Hand geometry is the measurement and comparison of the different physical characteristics of the hand. Although hand geometry does not have the same degree of permanence or individuality as some other characteristics, it is still a popular means of biometric authentication. Organizations are using hand geometry readers in various scenarios, including time and attendance recording, where they have proved extremely popular.
- ***Retina Scan****:* A retina scan provides an analysis of the capillary blood vessels located in the back of the eye; the pattern remains the same throughout life. A scan uses a low-intensity light to take an image of the pattern formed by the blood vessels. Retinal scanning can be quite accurate but does require the user to look into a receptacle and focus on a given point. This is not particularly convenient if you wear glasses or are concerned about having close contact with the reading device. For these reasons, all users do not warmly accept retinal scanning, even though the technology itself can work well.
- ***Iris Scan****:* Like a retina scans, an iris scan also provides unique biometric data that is very difficult to duplicate and remains the same for a lifetime. An iris scan provides an analysis of the rings, furrows and freckles in the colour ring that surrounds the pupil of the eye Iris scanning, undoubtedly the less intrusive of the eye-related biometrics,

conventional camera element and requires no close contact between the user and the reader.

- ***Signature****:* A signature is another example of biometric data that is easy to gather and is not physically intrusive Signature verification analyses the way a user signs her name. Signing features such as speed, velocity, and pressure are as important as the finished signature's static shape.
- ***Voice Analysis****:* Like face recognition, voice biometrics provides a way to authenticate identity without the subject's knowledge. Voice authentication is not based on voice recognition but on voice-to-print authentication, where complex technology transforms voice into text. Voice biometrics has the most potential for growth, because it requires no new hardware—most PCs already contain a microphone. However, poor quality and ambient noise can affect verification. In addition, the enrolment procedure has often been more complicated than with other biometrics, leading to the perception that voice verification is not user friendly.

VIII. APPLICATION AREA

There are many areas where it is applicable and playing a vital role to reduce the human efforts and reflection of technology for the benefits of society, as follows:

1) E-attendance
2) Military
3) Hospitals
4) Research centres
5) Universities and Colleges
6) Public and Private Organization's
7) Railways and Bus stands

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