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"BIOMETRIC IDENTIFICATION USING IRIS RECOGNITION SYSTEM"

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***Abstract*— Biometric Recognition being the most appropriate and up-to-date identification technique is used in different fields due to uniqueness of the various physiological and behavioral traits like finger prints, hand geometry, face recognition, iris recognition, voice recognition, handwriting etc. Iris recognition system is being extensively used as it provides genetically unique patterns that give a strong aspect for identification of a living being.**

***Keywords*— Biometric recognition, Iris recognition, Acquisition, Circular Houghman Transform, Hamming distance .**

INTRODUCTION

Biometrics refers to the identification or authentication of an individual based on certain unique features or characteristics. Biometric identifiers are the distinctive and measurable features that are used to label and describe individuals. There are two categories of biometric identifiers namely physiological and behavioral characteristics. Iris, fingerprint, DNA, etc. belong to the former whereas typing rhythm, voice, etc. belong to the later.

A biometric system usually functions by first capturing a sample of the feature, such as capturing a digital colored image of a face to be used in facial recognition or a recording a digitized sound signal to be used in voice recognition. The sample may then be refined so that the most discriminating features can be extracted and noises in the sample are reduced. The sample is then transformed into a biometric template using some sort of mathematical function which can be used for comparisons with all the existing templates in the database.

A good biometric is one which uses a feature that is highly unique. This reduces the chances of any two people having the same characteristics. The feature should also be stable so that it does not change over the period of time.

LITERATURE SURVEY

Since biometric authentication is a very up to date technique being used for security and identification purposes, plenty of work is done on it. *Tieniu Tan and Zhenan Sun* has proposed the iris acknowledgment calculation taking into account PCA (Principal Component Analysis) is initially presented and after that, iris picture combination technique is displayed. *Kefeng Fan* has proposed a productive procedure on iris picture procurement, iris de-nosing, iris limitation, and quality appraisal. *Lye Wi Liam proposed* a system consisting of two parts: Localizing Iris and Iris Pattern Recognition. They used digital camera for capturing image; from the captured images Iris is extracted**.** *V Saishanmuga Raja***,** proposed a method for personal recognition based on iris recognition using Genetic algorithm and Neural Network. The process of iris recognition consists of localization of the iris region and age group of data set of iris images followed by iris pattern acknowledgment. A Neural Network is used to reduce the low recognition rate, low accuracy and augmented time of recovery**.** *Xingguang Li Z.Wei* has proposed the comprehensive assessment of iris image quality to assess the overall quality score of an iris image. The paper has contributed for three aspects: (i) Three approaches for estimating quality metrics. (ii) Proposed a fusion method to combine six quality factors of an iris image into a unified quality score. (iii) Proposed a statistical quantization method to classify the iris images in a database into a number of quality factors. *Chengqiang Liu Mei Xie* proposed Direct Linear Discriminant Analysis (DLDA) which consolidates with wavelet change to concentrate iris highlight. *Dr. Ekta Walia* has worked on comparing the different biometric techniques and has given the clear view of accuracy received by each one of them. *Zhaofeng He, Tieniu Tan* has given a detailed study on segmentation of image of iris which extracts only the required features and discards the unwanted features.

IRIS BIOMETRICS

The iris is a thin circular structure in the eye. Its function is to control the diameter and size of the pupil and hence it controls the amount of light that progresses to the retina. A front view of the iris is shown in Figure 1.1 To control the amount of light entering the eye, the muscles associated with the iris (sphincter and dilator) either expand or contract the center aperture of the iris known as the pupil. The iris consists of two layers: the front vascular called as stroma and beneath it are the pigmented epithelial cells. The stroma is connected to the sphincter muscle which is responsible for the contraction of the pupil and also to the set of dilator muscles, responsible for the enlargement of the pupil. Iris of every person has

unique genetical organization which makes it best for identification and authentication. Iris of person's left and right eye too have different pattern and remains the same for a long period of time.

IRIS RECOGNITION

The iris is a well-protected organ that is externally visible and whose genetic patterns are very unique and remain stable throughout the person's life. Its high uniqueness and stability make it a good biometric. The unique patterns can be extracted using image processing techniques employed on a digitized image of the eye and then the results can be encoded into a biometric template which can later be stored in a database for future comparisons. The biometric template is usually created using some sort of mathematical operations. This biometric template is compared with all the other pre-existing templates in the database using certain matching algorithms in order to get the identification of the individual. If the image matches correctly with the stored image then it gives you the required accuracy and provides authenticity.

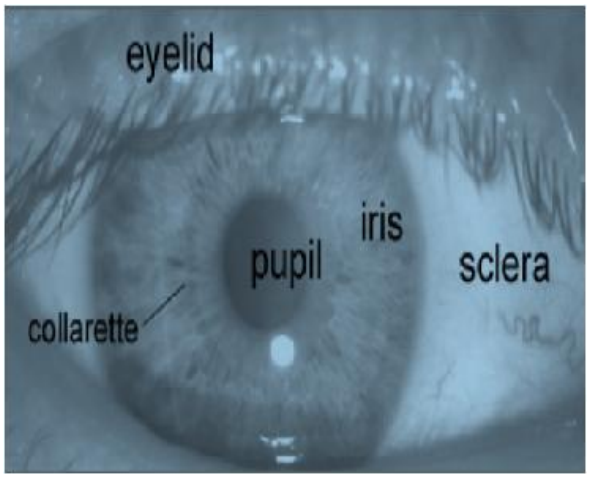

Fig. 1.1 Image of eye showing iris

Iris recognition process includes various tasks like:

- Image acquisition
- Image Segmentation
- Image Localization
- Image Normalization
- Encoding
- Template Matching

Image Acquisition:

Acquisition basically means getting the information from the source.Image of iris of the person is acquired by using optical lens, illuminators, image sensors etc which take care of various aspects like resolution, sensitivity, intensity of image etc.

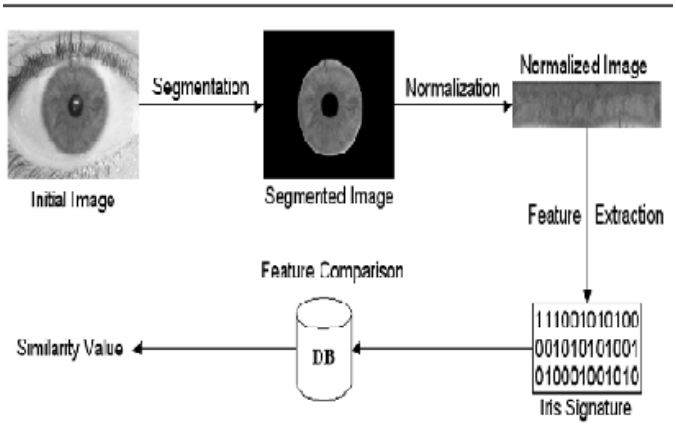

Fig 1.2 Iris recognition Process

Image Segmentation:

It is the process of obtaining all the different segments of the eye like pupil diameter, eyelashes, and eyelid etc. so that all the relevant and irrelevant information can be sorted out for future processing. It will increase the efficiency and thus save time. Segmentation includes applying edge detection method also that finds the pixels denoting the edges etc by fixing a threshold value. If the gradient is above the threshold value then it is accepted as an edge, if it is below the gradient then it is rejected and if it is between the two threshold values then it is accepted if it touches an accepted pixel. Canny edge detection method is used for the pixels.

Canny edge detection method

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision. Edges characterize boundaries and are therefore a problem of fundamental importance in image processing. Edges in images are areas with strong intensity contrasts – a jump in intensity from one pixel to the next. Edge detecting an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image.

The working steps of canny edge detector are given as:

Step1- Filter out any noise. The Gaussian filter is used for this purpose.

Step2- Find the intensity gradient of the image.

Step3- Non-maximum suppression is applied. This removes pixels that are not considered to be part of an edge. Hence, only thin lines (candidate edges) will remain.

Step4- Hysteresis: The final step. Canny use two thresholds (upper and lower):

a) If a pixel gradient is higher than the upper threshold, the pixel is accepted as an edge
b) If a pixel gradient value is below the lower threshold, then it is rejected.
c) If the pixel gradient is between the two thresholds, then it will be accepted only if it is connected to a pixel that is above the upper threshold.

Image Localization:

Localization focuses on obtaining biometric template for the various coordinates of the image that can be obtained by using number of transformation functions like Hough man transform function etc.

Circular Hough man Transformation

In automated analysis of digital images, a sub problem often arises of detecting simple shapes, such as straight lines, circles or ellipses. In many cases an edge detector can be used as a pre-processing stage to obtain image points or image pixels that are on the desired curve in the image space. It is often non-trivial to group the extracted edge features to an appropriate set of lines, circles or ellipses. The purpose of the Hough transform is to address this problem by making it possible to perform groupings of edge points into object candidates by performing an explicit voting procedure over a set of parameterized image objects.
The simplest case of Hough transform is the linear transform for detecting straight lines. In the image space, the straight line can be described as y = mx + b where the parameter m is the slope of the line, and b is the intercept (y-intercept). This is called the slope-intercept model of a straight line. In the Hough transform, a main idea is to consider the characteristics of the straight line not as discrete image points (x_1, y_1), (x_2, y_2), etc., but instead, in terms of its parameters according to the slope-intercept model, i.e., the slope parameter m and the intercept parameter b. In general, the straight line y = mx + b can be represented as a point (b, m) in the parameter space. However, vertical lines pose a problem. They are more naturally described as $x = a$ which give rise to unbounded values of the slope parameter m. Thus, for computational reasons, Duda and Hart proposed the use of a different pair of parameters, denoted r and θ (theta), for the lines in the Hough transform. These two values, taken in conjunction are defined as a polar coordinate.

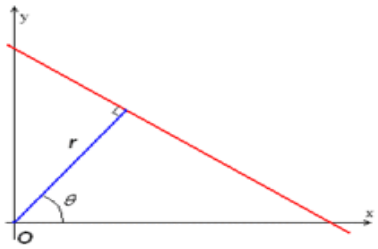

Fig 1.3 Circular Hough man Transformation

The parameter r represents the algebraic distance between the line and the origin while θ is the angle of the vector orthogonal to the line and pointing toward the half upper plane. If the line is located above the origin, θ is simply the angle of the vector from the origin to this closest point. Using this parameterization, the equation of the line can be written as

$$Y = -\frac{Cos\ Q}{Sing\ Q}\ x\frac{r}{Sin\ Q}$$

That can be rearranged to $r = x\cos Q + y\sin Q$.

Image Normalization:

It basically deals with obtaining the basic feature vector after segmentation and localization of different parts of the iris. It deals with obtaining the gray scale image parameters. All the parameters like accuracy, efficiency, error etc are observed with respect to normalised image.

Image Encoding:

Encoding deals with encoding of unique iris patterns obtained in form of bits code by various means like filters wavelets etc.

Image matching:

Matching deals with matching of the iris pattern code encoded with previously stored patterns in the database in the form of biometric templates.

HAMMING DISTANCE:

For matching, the Hamming distance was chosen as a metric for recognition, since bit-wise comparisons were necessary. The Hamming distance algorithm employed also incorporates noise masking, Hamming distance are calculated between two templates by using only important bits. The Hamming distance will be calculated using only the bits generated from the accurate iris region, and this modified by each template. Although, in theory, hamming distance is 0 when the result calculated on same iris templates but when put into practice this will not occur.

Formula: Given two vectors u, v $\in F_n$ we define the hamming distance between u and v, d (u, v), to be the number of places where u and v differ. Thus the Hamming distance between two vectors is the number of bits we must change to change one into the other.

Conclusion and future scope:

Iris recognition proves to be very efficient and promising technique as it gives accurate and reliable results. It can be easily used for authentication purposes in different fields like medical, education, etc. We have defined the basic steps used in biometric recognition using iris recognition. Iris recognition system gives unique results as it works on genetical

structure of iris and thus gives unique identification capability. In future different ways for the reduction of noise or unwanted segments can be brought into consideration to increase its efficiency and performance. Also various methods can be incorporated for the optimization of the feature vectors obtained during normalization as different algorithms can give different efficiencies and different time need. To reduce the execution time and matching the best possible outcomes optimized techniques can be used.

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