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Biometric Authentication using Iris for Email Access

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Abstract:
With the growing use of technology, authentication and security of an individual is essential and this can be achieved by biometric system. The primary aim of a biometric identification system is to recognize the identity of a person on the basis of his or her physiological or behavioral characteristics. Examples of these characteristics are fingerprint, face, voice, signature, iris and palm print. The basic function of this system is to scan and capture an image and a matching system is used to match input biometric image with stored biometric template by applying some sort of mathematical function. This paper presents a study of iris recognition technique. Iris recognition is the most reliable technique because of its uniqueness and stability over a period of time.

Keywords: Daugman's method ,Otsu'smethod, Four neighbour method, Hamming distance,Weiner filter, Projective

I. INTRODUCTION

Over past few decades the use of human biometrics for automatic identity verification has gained widespread importance. Biometrics for authentication gives trustworthy result with atmost accuracy. Biometrics are automated methods of recognizing a person based on physiological or behavioral characteristic. Basic aim of biometric system is automatically discriminate between subjects as well as protect data from unauthorized user.

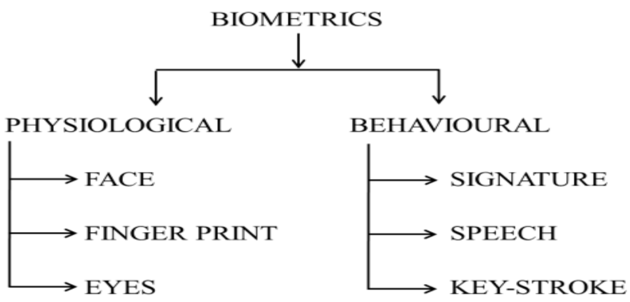


Figure.1. Classification of Biometrics

Out of various traits of classification mentioned above we are mainly concerned about the iris part of the biometric for authentication. Iris recognisation system is an area with a a lot of scope for work and progress.This involves identification of various complex and random patterns. Iris recognition system are known as real time identification system. This system is widely used in number of areas of regular use like aadhar, passport, activation security, attendance system, access of internet portals etc.

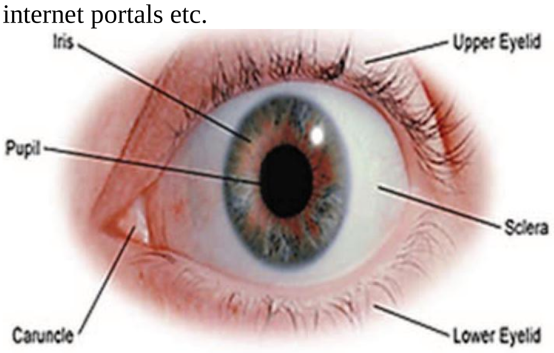


Figure.2. Front view of human eye

Various steps involved in iris recognition system are as follows:

Image acquisition: It is the process of creating photographic image of iris. Image of iris of the person is acquired using optical lens, illuminators, image sensors etc. this also take care of various aspects like resolution, sensitivity, intensity of image etc.

Iris localisation: It consists of finding the iris boundaries as well as eyelids, it means to detect the location of iris' inner and outer boundaries.

Iris segmentation: It is the process of obtaining different segments of the eye like pupil diameter, eyelashes, etc. so that all the relevant and irrelevant information can be sorted out. This will increase the efficiency.

Iris 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 normalized image.

Feature extraction: Feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization of steps.

Template matching: The template that is generated in the feature extraction process needs a corresponding matching metric. The metric gives us a measure of similarity between two iris templates.

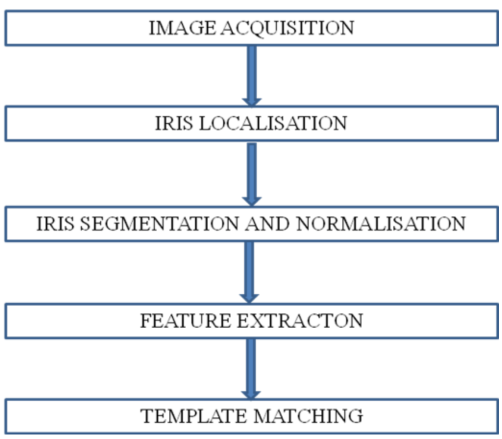


Figure.3.Methodology of Iris recognition system

II.LITRATURE SURVEY

Number of researches have been done in the field of biometrics. In this section the exhaustive literature survey is given about all the steps involved in iris recognisation system. Iris recognition studied by Manjunathswamy, Treveni[1] proposes sobel edge detection for iris localization in which approximation of gradient for image intensity function is used. Camus and Wildes presented a robust [2] ,real-time algorithm for localizing the iris and pupil boundaries of an eye in a close-up image. Tunku Abdul Rehman[3] proposed black hole search method to locate centre and area of pupil considering pupil to be the most darkest region of the eye. John Daugman[4] makes use of an integro-differential operator for segmentation for locating the circular iris and pupil regions, and also the arcs of the upper and lower eyelids. The integro-differential operator is defined as:

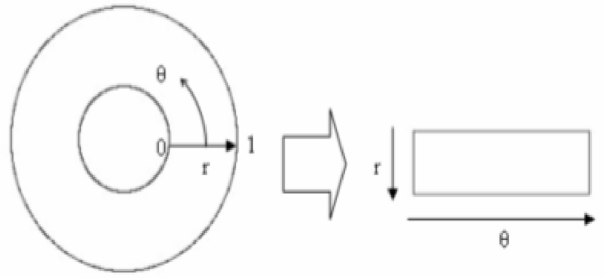
$$max_{(r,x_0,y_0)}\left|G_\sigma(r) * \frac{\partial}{\partial r}\oint_{r,x_0,y_0}\frac{I(x,y)}{2\pi r}ds\right|$$

where I(x,y) is the eye image, r is the radius to search for, Gσ(r) is a Gaussian smoothing function, and s is the contour of the circle given by r, x0, y0. After segmentation normalization is performed using daughman's rubber sheet model which is used to remap each point in the iris with its polar coordinates. Zhexue Li and Sangwoon Kim[5] have studied otsu's method for feature extraction process which uses discriminant analysis for maximizing separation between resultant classes of gray levels. Marium .T. Jaludi and Hind Alkhurdi[6] had proposed Wavlet encoding for feature extraction in which a number of wavelet filters, also called a bank of wavelets, is applied to the 2D iris region, one for each resolution with each wavelet a scaled version of some basis function. They also studied Gabor algorithm for texture representation and discrimination. Scientists[7] have studied four neighbor concept in which 4-connected pixels are neighbors to every pixel that touches one of their edges. These pixels are connected horizontally and vertically. Richard O. Duda and Peter E. Hart[8] have studied hough transform method for feature extraction to precisely detect lines and curve in any given image. The boundary of the curve is decided on the basis of requirement of the feature to be extracted. Lei Zhang ; Yongdong Zhang ; Jinhu Tang ; Ke Lu ; Qi Tians[9] studied hamming distance method for template matching. This method is feasible in practice but have some accuracy issues related to setting up of threshold. Qiu Shubo ; Gu Shuai ; Zhang Tongxing[10] have studied SVM revealed that this method provides almost 97% accuracy. Euclidean distance method still remains the most widely used method apart for hamming distance when it comes to feature extraction.

III. IMPLEMENTATION

The implementation of localization is perfomed in two steps:

First black hole search method is applied to locate iris and then daughman's rubber sheet model is applied in second step. Black hole search method is used to compute the center and area of a pupil.Since the pupil is the darkest region in the image, this approach applies threshold segmentation method to find the region. Firstly, a threshold is defined to identify the dark areas in the IRIS image. The dark areas are called as "black holes". The center of mass of these black holes is computed from the global image. The area of pupil is the total number of those black holes within the region. The radius of the pupil can be calculated from the circle area formula. Once this has been doe Daugnman's introdiffrential operator The operator searches for the circular path where there is maximum change in pixel values, by varying the radius and centre x and y position of the circular contour. The segmentation is put into practice with Daughman's rubber sheet model. The working of rubber sheet model s as follows:



The Rubber sheet basically used to take into account the various parameters that can be the cause of error such as inconsistencies in the pupil as well as the other factors that may cause irregular capturing of image such as dilation etc. In this way, the iris region is considered as a flexible rubber sheet around the iris boundary with the pupil's center as the reference point. Even though the homogenous rubber sheet model accounts for pupil. The feature extraction is implemented using Otsu's method since it proves better than that of wavelet encoding. Implementation of wavelet encoding is tedious since each pixel is represented as the some basis function. Otsu's method is used to automatically perform clustering-based on the image thresholding or the reduction of a gray level image to a binary image. The algorithm assumes that the image contains two classes of pixels following bi-modal histogram (foreground pixels and background pixels), it then calculates the optimum threshold separating the two classes so that their combined spread (intra-class variance) is minimal, or equivalently (because the sum of pairwise squared distances is constant), so that their inter-class variance is maximal. The gray level histogram is made for the two images that is the stored image and the image that is required to be compared for authentication. The histogram is then normalized comparing the two classes. Once the features have been extracted the matching is to be performed. Two basic methods for performing matching is hamming distance and Eucledian distance method. The comparision table clearly suggests that hamming distance proves to be the better technique. Hamming distance is matching metric employed by Doughman. The Hamming distance gives a measure of how many bits are same between two bit patterns. A decision can be made whether the two patterns generated are from different irises or from the same one. It is the sum of disagreeing bits (sum of the exclusive-OR between X and Y) over N ,the total number of bits in the bit pattern.

Table.1. Comparative study Table

SR NO.	FIRST IMAGE	SECOND IMAGE	HAMMING DISTANCE	EUCLIDIAN DISTANCE
1.	AEVAL1	6	0 MATCHED	0 MATCHED
2.	AEVAL2	6	0.144 MATCHED	1.6 MATCHED
3.	2	6	0.245 UNMATCHED	2.01 MATCHED
4.	6	9	0.224 UNMATCHED	1.9 MATCHED
5.	2	9	0.26 UNMATCHED	9.1 UNMATCHED

Formula for hamming distance is given as:

$$HD = \frac{1}{N}\sum_{j=1}^{N} X_j (XOR) Y_j$$

IV. FUTURE SCOPE

Since biometric authentication is a vast topic there is a lot of scope for future improvement in the model that has been proposed. Various factors can be taken into account to improve the system.

DEBLURRING

For most iris capturing scenarios, captured iris images could easily blur when the user is out of the depth of field(DOF) of the camera, or when he or she is moving. As a result, less-than ideal iris images can be easily produced by these systems, which usually result in recognition failures. Deblurring in the system can be done using weiner filter.

TILT INVARIENT [11]

There can be error in the system if iris that is captured is tilted by certain angle and then there is a possibility that system will give authentication error even for the correct person. Hence improvement can be made by making system tilt invariant. Tilt invarience means that the output remains unaffected in case the input image is deviated by certain angle. Tilt variations are compensated by determining the tilt of the test image with respect to the image stored in the database. Tilt variation can be compensated using projective transform. There are other methods also to implement tilt invariance projective transform being easy to implement practically is widely used.

V. CONCLUSION

Iris recognition proves to be the promising method for biometric authentication[12] [13] and can be use in various fields. We have discussed the various steps that will be involved in implementation of the system as well has discussed the method that can be used to implement the same amongst all the different methods studied. Since there is a lot of scope for future development in this field we have also studied the improvements that can be encorporated in the system for better performance and more accurate authentication.

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