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ALGORITHM FOR BIOMETRIC DETECTION APPLICATION TO IRIS

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ABSTRACT

Biometric system is a technology for identification or authentication of a living person grounded on a behavioral or physiological characteristic. There are so many biometric systems like fingerprints, voice, gait, iris etc. Other identification systems are available like PIN, password etc Among these biometric authentication system, iris identification has got increasing tending due to its high accuracy and reliability. Iris recognition system is based on pattern recognition techniques which are based on characteristics of iris. In this paper, an algorithm based on Iris biometric is proposed. The system takes the biometric data CASIA version 1.0. This algorithm gives the more accuracy.

Keywords: Iris biometric, hough transforms, mean square error.

I. INTRODUCTİON

Biometrics, which refers to authentication based on his or her physiological or behavioral characteristics, its capability to distinguish authorized person and an unauthorized. Since biometric characteristics are distinctive as it cannot be forgotten or it cannot be lost, for identification, person has to be present physically. Biometric is more reliable and capable than traditional knowledge based and token-based techniques. Biometric has also drawback i.e., if it is compromised then it is difficult to replace. Among all biometrics such as fingerprint, iris, retina, voice, signature etc., Iris-based Recognition is one of the most mature and proven technique. Iris is colored part of eye as in Figure 1. A person's two eye iris has different iris pattern, two identical twins also has different in iris patterns[13] because iris has many feature which distinguish one iris from other, primary visible characteristic is the trabecular meshwork, a tissue which gives the appearance of dividing the iris in a radial fashion that is permanently formed by the eighth month of gestation [14] and iris is protected by eyelid and cornea as shown in Figure 1. Its complex pattern can contain many distinctive features such as arching ligaments, furrows, ridges, crypts, rings, corona, freckles and a zigzag collarette [8]. Therefore increases security of the systems. Spoofing is very difficult with iris patterns as compare to other biometrics. For recognition of iris we needs to follow fives main steps: image capture; preprocessing, and segmentation (extraction the irisfrom the image of the eye area), and normalization (transform the iris in a polar coordinate to get rectangular image; feature extraction, which generates an iris

template; and matching of iris templates and a make decision to rejection or acceptation (according to threshold) . In this paper we developed a algorithm iris recognition include all this steps and we use the data base CASIA version 1.0 for testing

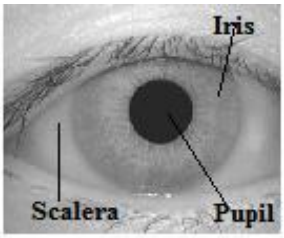


Figure 1

II. OUTLINE OF THE PAPER

The paper is organized in the following manner; section (1) Introduction of the iris, in section (3) related work of different researcher who worked on iris recognition with feature extraction and with classifier listed in tabular form, in section (4) proposed research work with preprocessing i.e., image acquisition, iris localization & normalization, feature extraction with section (5), section (6), section(7) and section (8).In section (9) Matching and in section (10) experimental results and discussion, finally conclusion in section (11).

III. RELATED WORK

Various approaches exist in the past for iris recognition for person identification which includes John Daugman's Iriscode [6] [7]. However proposed work uses scanning method for pupil detection and iris localization and five level decomposition techniques for haar wavelet for iris feature extraction to get 90 feature vector elements for effective iris recognition. Advantages of proposed methods are its computational simplicity and speed. This method is less likely to be affected by environmental factors as compared to Gabor wavelet The Iris Recognition system's main work role is to provide compact and significant feature extraction algorithm for iris images with reduced false rejection rate. The extracted feature should have high discriminating capability and the segmented iris image should be free from artifacts [1].

Daugman [4] [5] used Integro-differential operator for pupil detection and a multiscale quadrature two-dimentional (2-D) Gabor filter to demodulate phase information of an iris image to create an Iriscode for authentication by comparing the Iriscode stored in database. Li.Ma et al., [10] used Hough transformation and extracted features using spatial filter, this technique first converts the round image of the iris into rectangular pattern by unwrapping circular image. Wildes et al., [15] uses Hough transform and gradient edge detection for pupil detection and Laplacian pyramid for analysis of the Irisimages. Boles and Boashash [17] uses zero-crossing method with dissimilarity functions of matching. Lim et al., [16] 2D Haar Transform for feature extraction and classifier used are initialization method of the weight vectors and a new winner selection method designed for iris recognition. A. Poursaberi and H. N. Araabi [1, 2] use wavelet Daubechies2 for feature extraction and two classifiers such as Minimum Hamming Distance and Harmonic mean. Li. Ma et al., [9] class of 1-D wavelet i.e., 1-D Intensity signals for feature extraction and for feature matching they have used expanded binary feature vector with exclusive OR operations. Md. Rabiul Islam et al., [13] used 4-level db8

wavelet transform for feature extraction and hamming distance with XOR for pattern matching. In this paper we will be using three step process which is based on the error rate. The algorithm is tested on the CASIA iris image database.

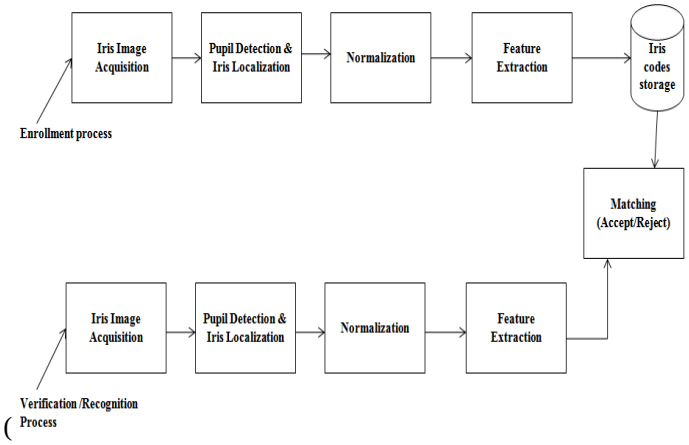
IV. THE PROPOSED APPROACH

The algorithm consists 3 steps to achieve desired results. Therefore proposed systems algorithm, which is as follows:

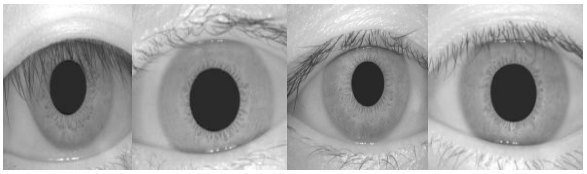
Step1: **Preprocessing and Segmentation**: In preprocessing and segmentation, it extracts the image of the iris from eye image. The extracted iris image is used for further processing so it require more accuracy for achieving success in later process.

Step 2: **Encoding:** In this, an iris template is genrate here we are using Gabor filter. An iris template is basically a binary vector that contains the information of iris.

Step 3: **Matching or Verification:** In this process we determine that the iris should Accept or reject by equating the stored pattern and with the submitted pattern. Camparison of iris pattern is based on hamming distance between the two codes of iris.



Here we use CASIA data base version 1.0. in which 756 irises (eyes) of 108 subjects . Each image of iris is greyscale. Below fig. shows examples of images CASIA version1.0 database.



Images example of CASIA database

4.1 Preprocessing & Segmentation

Preprocessing and segmentation is very important step it has to extract the iris properly from the given image. Here we used filter for smoothing. After that Hough transform is used for segmentation.

4.1.1 Smoothing

Iris image consist like eyelids, eyelashes, pupil etc. To cut down the impression of noise in the images of iris, we applied a Gaussian filter. Gaussian filter will squeeze the black color part of eyelashes and hold those accompanying only to the pupil. Fig. 3 shows the original eye image and the resultant image after filtering.

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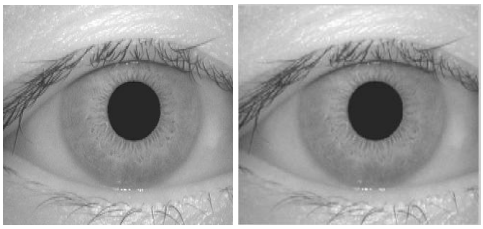


(a) (b)

Fig. 3 Result of Gaussian Filter: (a) Original image (b) filtered image.

4.1.2 Canny & Sobel Filter

There are many methods are available for edge detection. Here, we applied in the first part canny filter is applied and in second part Sobel detector is used. Fig. 3 represents the output of applied filter to an eye image of the database CASIA.

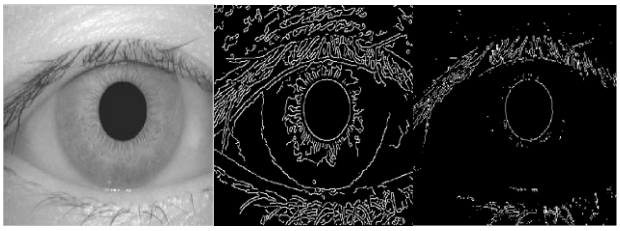


Fig.3.Edge Detection Output: (a) Filtered image (b) Canny edge (c) Sobel edge.

4.1.3 Hough Transform

To isolate characteristics from an image of a particular shape hough transform technique can be used. It is suited for the identification or detection of steady curves like circles, lines etc. The important feature of hough transform is liberal of gaps in characteristic boundary descriptions also it is less effected by noise of image. Here hough transform is applied from tow times. First to detect the pupil and secondly for iris detection.

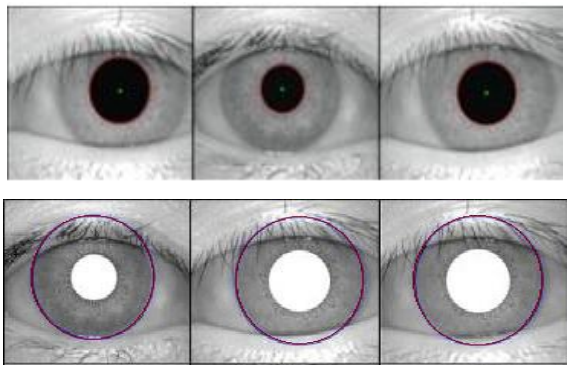


Fig. 4 Hough Transform output.

4.1.4 Insulation of the Eyelids and Eyelashes

In an eye image many noise may be confront like iris texture may be dealt by eyelids and eyelashes. These kind of noises can be presence due to the eyelids when the eye opening or the presence of eyelashes with the irregular shape and random position. This noise problem makes it very tough to recognize the iris. Up to 60% of the iris texture may be blotted out by this noise. We have take out this type of noise by tracing horizontals lines in area of eyelids and eyelashes and the output is in Fig. 5

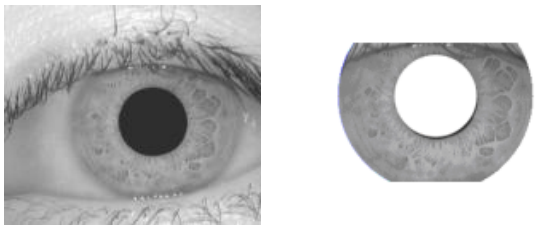
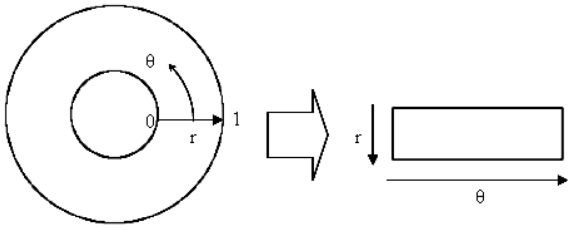


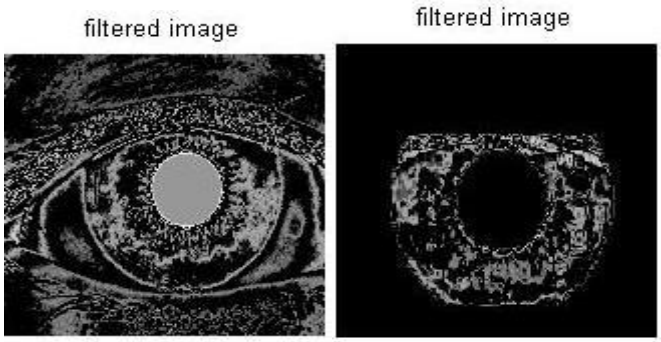
Figure 5

4.2 Encoding

In encoding process, first we represented the iris to a rectangle Daugman's rubber sheet model[1].Secondly, we used Gabor filter for extracting the feature of iris code. It also generate a binary template as shown in fig.



Daugman's rubber sheet model



Iris template

01 00 00 10 11 11 01 01 00 10 10 11 11 01 01 00 10 10 11 01 01 01 01 01 00
10 10 01 11 00 10 01 10 00 10 10 00 10 01 10 00 11 01 10 11 00 01 01 11 10

4.3 Matching

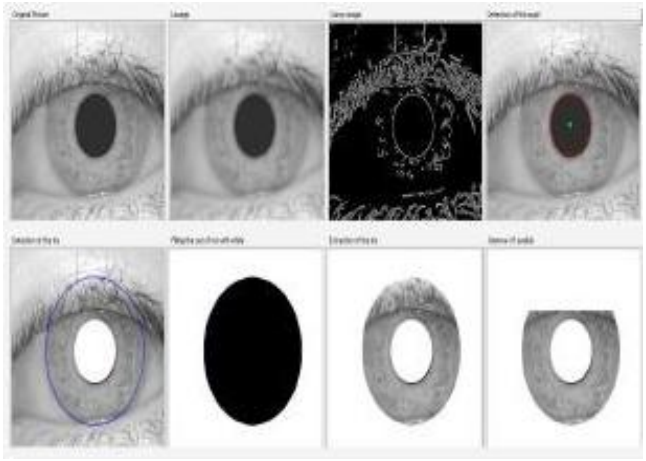
After performing encoding, a binary template is generated which is further used to calculate Hamming distance. Hamming distance is Xor based formula to calculate the distance can be compared by computing a Hamming distance between iris codes.

$$HD = \frac{1}{N - \sum_{k=1}^{N} Xn_k (OR) Yn_k} \sum_{j=1}^{N} X_j (XOR) Y_j (AND) Xn'_j (AND) Yn'_j$$

4.3.1 Experimental Results

Here Windows 8 is used, which includes the MATLAB 2011 and Image Processing Tool: in which Communications System Toolbox > Feature Detection, Extraction, and Matching, Image Processing Toolbox >

Image Analysis > Object Analysis.. We tested the technique above described on CASIA database version 1.0 containing 756 images.Fig.6 represents the different steps of the iris segmentation.



In this paper, we also calculated the mean square error (MSE) between two irises for performing matching operation. In this step first we calculate the MSE between the store iris image code and the input iris. When the iris recognition is performed we calculate MSE between the stored and the recent value if both are same then the value of MSE is zero or person is correct and accepted else reject it. As shown in below table when MSE is calculated between stored test image1 and input test1 image the output is zero while calculating MSE between stored test2 image and input image1 output is 0.648. It means the both the iris are not same.

Stored Image Data	**Calculated MSE between Input Image Test1 and stored data**	**Calculated MSE between Input Image Test2 and stored data**
Test1	0.00	0.648
Test2	0.648	0.00
Test3	0.750	0.683
Test4	0.631	0.642
Test5	0.670	0.648

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