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Improved FAR and FRR using Wavelet Transform in Iris Recognition System

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Abstract— Iris recognition is emerging as one of the important methods of biometrics-based identification system. It consists of five major steps iris acquisition, segmentation, normalization, feature extraction and matching. In this work, we used Wavelet transform function in place of Hough transform function. After extraction of feature of iris used feature optimizations technique for better selection of feature. The better selected feature gone through process of pattern generation and finally matched the template value and improved the FAR and FRR of iris image.

Keywords— Biometric, FAR, FRR, Hough transform, Wavelet transform, ACO etc.

I. INTRODUCTION

Biometrics Technology is a common and reliable way to authenticate the identity of an individual person based on unique physical and behavioral characteristics. It employs physical characteristics such as iris, fingerprints, hand geometry, face and behavioral characteristics such as voice, signature, keystroke patterns etc.

A. Iris

Iris is the colored portion of the eye lying between pupil and sclera [3]. It is the most reputed and most reliable among all biometric method. It cannot be stolen or cannot be easily morphed by any person. Iris in an eye can be identified as shown in figure 1.

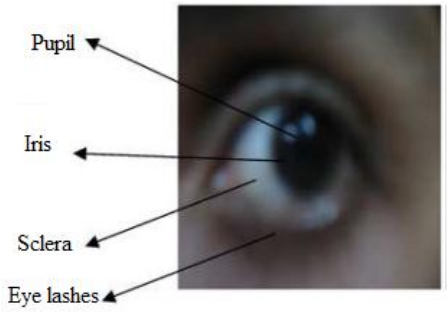

Figure 1 Human Eye

B. False Acceptance Rate (FAR)

Probability that a system will incorrectly identify an individual or fail to reject an imposter. It represents the probability that a given biometric system will accept an incorrect input as a positive match.

C. False Rejectance Rate (FRR)

Probability that a system will fail to identify a registered user. It represents the probability that a biometric system will incorrectly reject an input as a negative match.

D. Wavelet Transform

Wavelets can be used to decompose the data in the iris region into components that appear at different resolutions. Wavelets have the advantage greater than traditional Fourier transform in that the frequency data is localized, allowing features which occur at the same position and resolution to be matched up. A number of wavelet filters, also called a bank of wavelets, are applied to the 2D iris region, one for each resolution with each wavelet a scaled version of some basis function. The output of applying the wavelets is then encoded in order to provide a compact and discriminating representation of the iris pattern.

E. Hough Transform

The Hough transform is a standard computer vision algorithm that can be used to determine the geometrical parameters for a simple shape near in an image, and this has been adopted here for circle detection. The main advantage of the Hough transform technique is its tolerance for gaps in feature boundary descriptions and its robustness to noise.

II. RELATED WORK

F. Image Acquisition

It is to capture a sequence of iris images from the subject using a specifically designed sensor.

G. Iris Localization & Segmentation

In iris localization, one detects the inner and outer boundaries of iris, and removes the eye lashes of eye lids that may cover iris region [1]. Both the inner boundary and the outer boundary of a typical iris can be taken as circles. Compared with the other part of the eye, the pupil is darker. We detect the inner boundary between the pupil and the iris. The outer boundary of the iris is more complicated to detect because of the low contrast between the two sides of the boundary. We detect the outer boundary by maximize changes of the perimeter- normalized along the circle. The technique is found to be proficient and effective.

H. Iris Normalization

Iris normalization is required to convert the iris image to polar coordinates from Cartesian coordinates. Feature extraction from normalized iris pattern requires segmented iris image to be transformed to polar coordinates from Cartesian coordinates. For this Daughman's rubber sheet model is implemented.

I. Feature Extraction & Encoding

The most important step in automatic iris recognition is the ability of extracting some unique attributes from iris, which help to generate a specific code for each individual.

J. Matching & Identification

After template creation, compare the templates with stored iris database templates and decided the iris image is authentic or imposter.

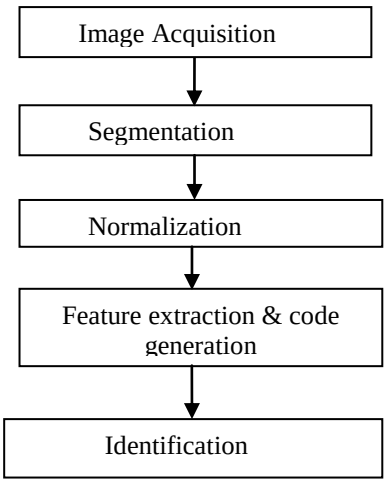

Figure 2 Steps of Iris Recognition System

III.PROPOSED WORK

In this paper, we proposed an optimized feature selection process for iris image template creation. The feature extraction process is performed by wavelet transform function. Feature extraction can be defined as the act of mapping the image from image space to the feature space. Wavelet transform decomposed image into different layers, the decomposed layer differentiate by horizontal, vertical and diagonal. The extracted feature set passes through optimization process, the optimized process optimized the feature of iris image and generate an optimized template of iris image.

K. Wavelet Transform

The Wavelet transform is used to extract features from the enhanced iris images. The Wavelet transform breaks an image down into four sub-sampled images. The results consist of one image that has been high-pass filtered in the horizontal and vertical directions (*HH* or Diagonal coefficients), one that has been low-pass filtered in the vertical and high-pass filtered in the horizontal (*LH* or Horizontal coefficients), one that has been low-pass filtered in the horizontal and high-pass filtered in the vertical (*HL* or Vertical coefficients), and one that has been low-pass filtered in both directions (*LL* or details coefficient).

L. Improved SMV-ACO

We proposed a new feature subset selection method for finding one-against-one recognition for iris recognition without alteration of support vector machine. The proposed feature subset selection method is based on ant colony optimization; ant colony optimization is very famous meta-heuristic function for searching/finding similarity of data. In this method, we have introduced continuity of ants for similar features and dissimilar features collect into next node. In

this process, ACO finds optimal selection of feature subset. Suppose ants find features of similarity in continuous root. Every ant of features compares their property value according to initial feature set. When deciding data is noise and outlier, we should consider two factors: importance degree and easiness degree of noise and outliers. While walking ants deposit pheromone on the ground according to importance of the outlier and follow, in probability pheromone previously lay by other ants and the easiness degree of the noise.

Process block diagram given below-

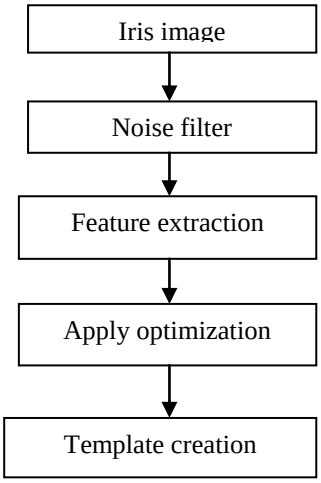

Figure 3 Proposed work of Iris Recognition

After template creation, compare the templates with stored iris database templates. To verify a person's identity, the calculated iris templates need to be matched with the stored template. Similarity of two iris codes is obtained using hamming distance. Low hamming distance means higher similarity.

The Hamming distance (HD) gives a measure of how many bits are the same between bits patterns. Using the Hamming distance of two bit codes, a decision can be made as to whether the two patterns are generated from different irises or from the same ones means can decided the iris image is authentic or imposter.

IV. RESULT ANALYSIS

To investigate the effectiveness of the proposed method for Iris Recognition System. We perform some experimental task, all these tasks perform in MATLAB7.5 software and well famous CASIA Iris Image Database for experimental process, which contain of different types of iris and we get the results of FAR and FRR by using Wavelet transform and compare previous results of Hough transform which are shown in table. Finally we analyzed that the wavelet transform based results are superior to other technique. The results of FAR and FRR are following in table .

No. of user	**FAR**		**FRR**	
	Hough	**Wavelet**	**Hough**	**Wavelet**
1	1.00000	0.990900	1.0000	0.991900
2	0.972222	0.963122	0.96667	0.958567
2	0.990741	0.981641	0.977778	0.969678
4	0.992370	0.982620	0.98333	0.975233
5	0.997222	0.988122	0.986667	0.978567
6	0.998148	0.989048	0.988889	0.980789
7	0.998677	0.989577	0.990476	0.982376
8	0.999008	0.989908	0.991667	0.983567
9	0.999228	0.990128	0.992593	0.984493
10	0.999383	0.990283	0.993333	0.985233
11	0.999495	0.990395	0.993939	0.985839

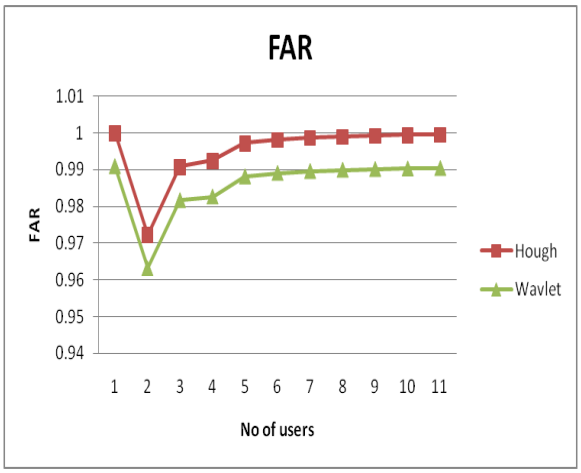

Figure 4 Calculation of FAR using Hough and Wavelet transform

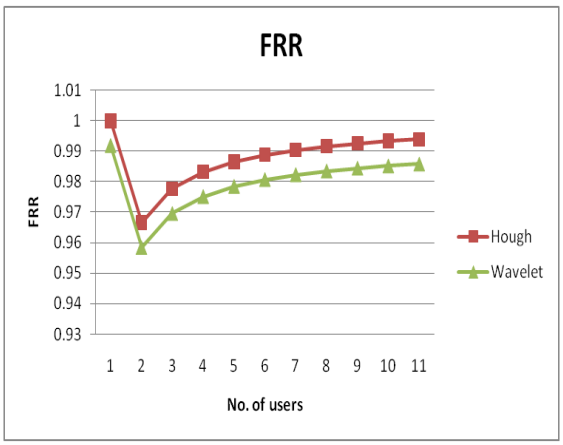

Figure 5 Calculation of FRR using Hough and Wavelet transform

V. CONCLUSIONS

In this paper, we improved Iris Recognition System using discrete wavelet transform and features selection process by Ant Colony Optimization. After extraction of feature of iris used feature optimizations technique for better selection of feature. Corners in the transformed iris image are detected using covariance matrix of change in intensity along rows and columns. The better selected feature gone through process of pattern generation and finally matched the template value and improved the FAR and FRR of iris image.

The process of feature selection in iris recognition used wavelet and ant colony optimization process is very complex and takes more time for generation of template. In future we reduce the computational time and generate more reliable template for iris recognition.

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