IMPLEMENTATION OF IRIS RECOGNITION USING FUSION OF HOMOGENEOUS FEATURES

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ABSTRACT

Biometrics is the integral part of the identification of individuals that is identity management. The work presented in this paper consists of developing an iris recognition system which will use the multiple features of the same person that is left and right eyes. This will help to increase the accuracy of the system. The system consist of segmentation stage which uses integro-differential operator for localizing the circular iris and pupil region, occlusions like eyelids and eyelashes, reflections. The segmented region was then normalized into rectangular block of fixed dimension. Finally, phase as a feature is extracted from normalized image using 1D-Log Gabor extraction. These extracted features scores of left and right iris are fused at feature level. The Hamming distance is used for matching the left with left image database and right with right image database.

Keywords: Biometrics, Feature Level Fusion, Iris, Log Gabor, Segmentation

I. INTRODUCTION

Iris is one of the features of the human body that can be used for the identification because of its uniqueness. Authentication plays a major role to defend against intruders. The three main types of authentication are: Something you know such as a password, something you have such as a card or token, something you are such as biometrics. Biometric identification utilizes physiological and behavioral characteristics to authenticate a person's identity as shown in Fig. 1.

Physical characteristics that may be used for identification include: Fingerprints, palm prints, hand geometry, retinal patterns and iris patterns. Behavioural characteristics include: Signature, voice pattern and keystroke dynamics. As in Figure 1 biometric system works by capturing and storing the biometric information and then comparing the scanned biometric with what is stored in the repository. A good biometric is characterized by use of a feature that is highly unique, stable, be easily captured.

Identity management refers to the challenge of providing authorized users with secure and easy access to information and services across a variety of networked systems. A reliable identity management system is a critical component in several applications that render their services only to legitimate users. Examples of such applications include physical access control to a secure facility, e-commerce, access to computer networks and welfare distribution. The primary task in an identity management system is the determination of an individual's identity.

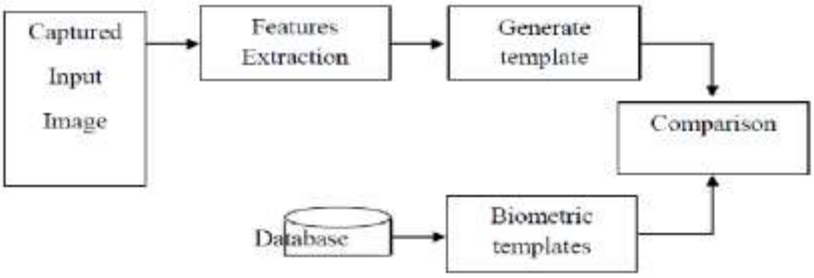

Figure 1: Biometric System

Traditional methods of establishing a person's identity include knowledge-based (e.g., passwords) and token-based (e.g., ID cards) mechanisms. These surrogate representations of the identity can easily be lost, shared or stolen. Therefore, they are not sufficient for identity verification in the modern day world. Biometrics offers a natural and reliable solution to the problem of identity determination by recognizing individuals based on their physiological and/or behavioral characteristics that are inherent to the person.

Iris recognition is a system that that will work as follows Image processing techniques can be employed to extract the unique iris pattern from a digitized image of the eye, encode it into a biometric template, which can be stored in a database. This biometric template contains an objective mathematical representation of the unique information stored in the iris, and allows comparisons to be made between templates. When a subject wishes to be identified by iris recognition system, their eye is first photographed, and then a template created for their iris region. This template is then compared with the other templates stored in a database until either a matching template is found and the subject is identified, or no match is found and the subject remains unidentified.

It is not always possible to capture the good quality of the single eye of the same person every time .so if we can use the both the eyes of the same person that is the multiple features the problem of missing features due to the noise or any environmental condition can be solved.

In this paper we proposed a work to consider both the eyes of the person to be identified. For this first the image is captured and an eye pair is detected and is classified as left and right and is stored in separate databases. And next the images in the databases are segmented and are normalized. Then the features are extracted and the scores of both the left and right iris are fused to get the single sore and that score is matched with the others for decision making.

II. PREVIOUS WORK

Many literary works uses the different methods for the iris recognition. [1] Make use of a constellation model to perform the iris segmentation task. The constellation model places multiple integro-differential operators at the current evaluating pixel in order to find the local minimum score. The pixel found to be at local minimum will be employed in the next iteration. The process is then iterated until it converges or the predefined maximum number of iterations is reached.

Two neutral network classifiers were trained by utilize local color features to classify image pixels into sclera/non-sclera and iris/non-iris categories. The trained classifiers operated in cascade order by firstly classifying sclera and then feeding the classified sclera pixels into the next classifier for iris pixels classification [2]. A new iris segmentation approach, which has a robust performance in the attendance of heterogeneous as well as noisy images, has been developed in this. The procedure starts with the image-feature extraction where three discrete i.e., (x, y) which corresponds to the pixel position, and z which corresponds to its intensity values has got extracted for each and every image pixel, which is followed by the application of a clustering algorithm which is the fuzzy K-means algorithm[3].

Simultaneously exploits two set of the features for sclera and iris classification. Iris features are extracted by exploiting localized Zernike moments. Sclera features are extracted by using discriminant color features. Pixel based strategy is in use [4]. Ocular recognition is a new area of investigation targeted at overcoming the limitations of iris recognition performance in the presence of non-ideal data. The coir database of metadata was developed by collecting the ocular features from the images which is already present in the database. Scale-invariant feature transform was able to dependably match ocular features without the need for segmentation [5].

In an iris recognition noise is considered as of the challenging issues. Where these noises having the different thresholds compare to normal regions, may cause improper detection of iris [6].To overcome the problems in the above mentioned works that only one iris feature is used always but we developed work for both iris in the remaining section.

III. PROPOSED METHOD

The proposed system as shown in fig.2 is to be composed of a number of sub-systems, which correspond to each stage of iris recognition. These phases are segmentation – locating the iris region in an eye image, normalization – creating a dimensionally consistent representation of the iris region, and feature encoding – creating a template containing only the most discerning features of the iris. An eye image will be an input to the system eye, and will get an iris template as the output, which will provide a mathematical representation of the iris region.

3.1 Segmentation

Segmentation is the first part of the iris recognition system after capturing the eye image. Daugman makes use of an integro-differential operator 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 in equation 3.1. This is done for the left and right eyes of the person.

$$\max_{(r,x_0,y_0)} G_\sigma(r) * \oint_{r,x_0,y_0} \frac{I(x,y)}{2\pi r} ds \qquad (3.1)$$

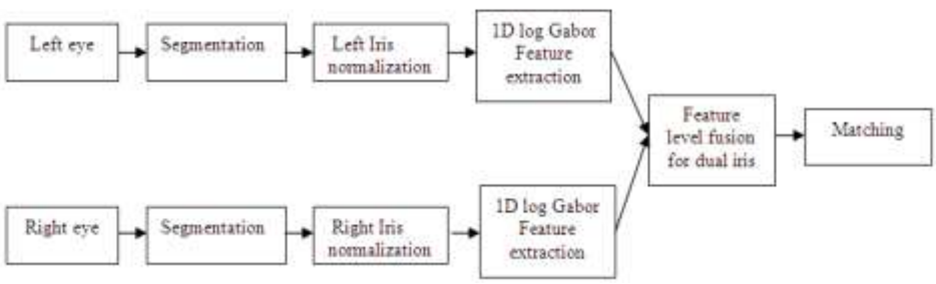

Figure 2: Proposed Method

3.2 Iris Normalization

Once the iris region is successfully segmented from an eye image, the next stage is to transform the iris region so that it has fixed dimensions in order to allow comparisons. Dimensional inconsistencies between eye images are mainly due to the stretching of the iris caused by pupil dilation from varying levels of illumination. For normalization of iris regions a technique based on Daugman's rubber sheet model is employed. :

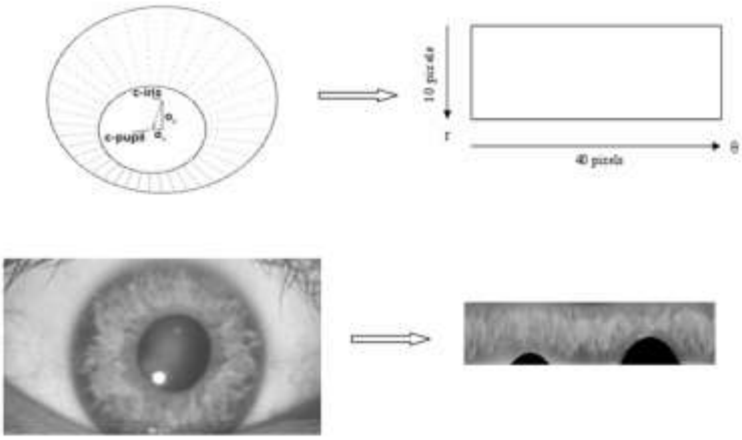

Figure 3: Outline of the Normalization Process

The illustration of normalization process is as shown in fig.3 with radial resolution of 10 pixels, and angular resolution of 40 pixels. Pupil displacement relative to the iris centre is exaggerated for illustration purposes. Once the two irises have the same dimensions, features are extracted from the iris region by storing the intensity values along virtual concentric circles, with origin at the centre of the pupil.

3.3 Feature Encoding

The most discriminating information present in an iris pattern must be extracted in order to improve the accuracy of the system. Evaluation between templates can be made accurately so only the important features of the iris must be encoded so that accuracy is improved. The template that is generated in the feature encoding process will also need a corresponding matching metric, which gives a measure of similarity between two iris templates.

Feature encoding as shown in fig.4 was implemented by convolving the normalized iris pattern with 1D Log-Gabor wavelets. The 2D normalized pattern is broken up into a number of 1D signal, and then these 1D signals are convolved with 1D Gabor wavelets. The rows of the 2D normalized pattern are taken as the 1D signal; each row corresponds to a circular ring on the iris region. The angular direction is taken rather than the radial one, which corresponds to columns of the normalized pattern, since maximum independence occurs in the angular direction.

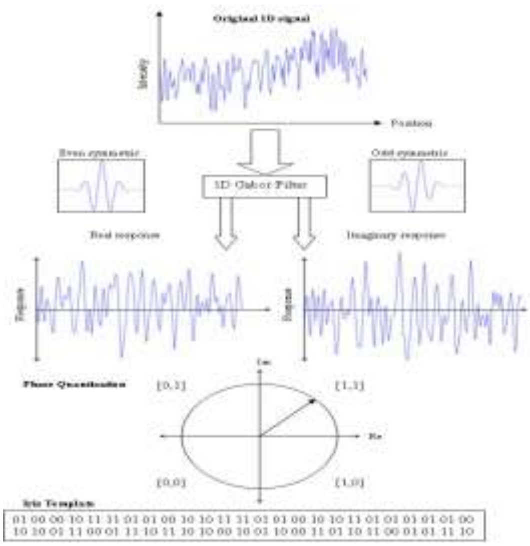

Figure 4: Feature Extraction

3.4 Feature Level Score Fusion

Feature level fusion refers to combining different feature vectors that are obtained from one of the following sources; multiple sensors for the same biometric trait, multiple instances of the same biometric trait, multiple units of the same biometric trait or multiple biometric traits.

When the feature vectors are homogeneous a single resultant feature vector can be calculated as a weighted average of the individual feature vectors. Feature level fusion can keep the intolerance of different biometric modal as much as possible. For dual iris fusion, suppose I_L and I_R are the left and right iris binary feature vectors. The complex fusion vector can be expressed as

$$F_{I_i} = I_{L_i} \times I_{R_i} \quad i \epsilon n \qquad (3.2)$$

3.5 Matching

Normalized correlation between the acquired and database representation for goodness of match. This is represented as 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, so that only significant bits are used in calculating the Hamming distance between two iris templates. Now when taking the Hamming distance, only those bits in the iris pattern that match to '0' bits in noise masks of both iris patterns will be used in the calculation. The Hamming distance will be calculated using only the bits generated from the true iris region, and this modified Hamming distance formula is given as in equation 3.5

$$HD(A,B) = \frac{\|Code_A \otimes Code_B \cap Mask_A \cap Mask_B\|}{Mask_A \cap Mask_B} \qquad (3.5)$$

The distance between two feature vectors are calculated after fusing of the left and right iris is given by the following equation 3.6

$$HDF = (HD(I_{L_1}, I_{L_2}), HD(I_{R_1}, I_{R_2})) \qquad (3.6)$$

I_{L_1} and I_{L_2} are the left iris of first and second templates, I_{R_1}, I_{R_2} are the right iris template.

IV. CONCLUSION

For multibiometric systems, the effective fusion strategy is necessary for combining information from several single biometric systems. In this paper, an efficient multibiometric fusion approach that fuses left and right iris. It has better recognition performance and can defense the forgery attacks. High accuracy is obtained because even the twins don't have the same iris pattern, and patterns of the left and right eyes are unique.

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