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Feature Extraction of an Iris Image to Develop Iris Based Biometric Recognition System

Kameshwar Nishad[1], Sandeep B. Patil[2]

Abstract— *An iris based biometric recognition system provides identification of an individual based on a unique feature or characteristic possessed by that individual. Iris recognition is consider as the most reliable and accurate biometric identification system. In this paper we explore the performance of the iris based recognition system. We take iris image of ten different people and after segmentation and normalization we create iris template. This iris template can further be used for iris matching and hence person recognition. For determining the iris feature extraction performance the system database of digitized grayscale eye images were used.*

Keywords— *Iris segmentation, iris normalization, iris template identification, feature extraction, grayscale eye image*.

I. INTRODUCTION

Extraction of biometric feature of an individual is an important and necessary step to design biometric person identification system. Grey scale iris image is taken from one of the database available and preprocessing was done. Segmentation was performed to localize the iris region. The extracted iris region was then normalized into a rectangular block with constant dimensions to avoid inconsistencies. The performance of an automated iris recognition system is affected by the accuracy of the segmentation process used to localize the iris structure.

Normalized iris image is then encoded with 1-D log gabor filter which gives a uniform bit pattern. This bit pattern is called Iris template and can further used in a biometric person identification system based on iris template matching.

II. METHODOLOGY

In this section we discuss the development of a iris based biometric person recognition system in details.

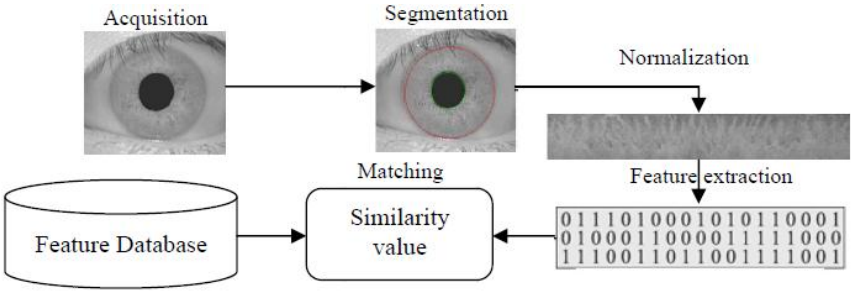

Fig 1.1. A typical iris recognition system.

Database Generation

We took grayscale iris images of both left and right eyes of 10 persons for our database. The iris samples was taken from standard CASIA database.

A classical iris recognition system includes a series of steps: image acquisition, iris pre-processing (includes localization and normalization), feature extraction.

Image Acquisition

This step is one of the most important and deciding factors for obtaining a good result. A good quality clear image can minimize the process of noise removal and helps in avoiding the errors in calculation.

Pre-Processing

The iris image that contains irrelevant parts such as eyelid, eyelash, pupil, etc should be removed. The original image needs to be pre-processed for the purpose of analysis. The pre-processing is consists of two steps: 1. iris localization or segmentation and 2. iris normalization.

Iris Localization

The part of the eye which carry information is the iris part. It lies between the scalera and the pupil. The localization/segmentation process consists of creating two rings for isolating the iris part from the iris image. Daugman's integro-differential operator is used to detect iris ring.

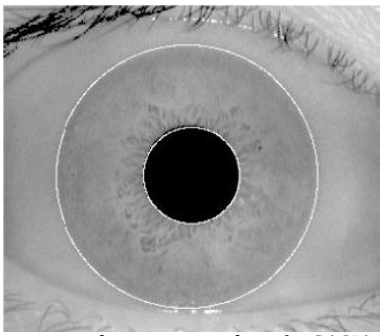

Fig. Segmentation of an iris images from the CASIA database.

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Iris Nomalization

The normalization process is applied to produce a uniform iris area. It transforms the circular iris region into a rectangular region with fixed dimension. Again Daugman's rubber sheet model is used to perform normalization which remaps each point within the iris region to a pair of polar coordinates (r, θ) where *r* is on the interval [0,1] and θ is angle [0,2π].

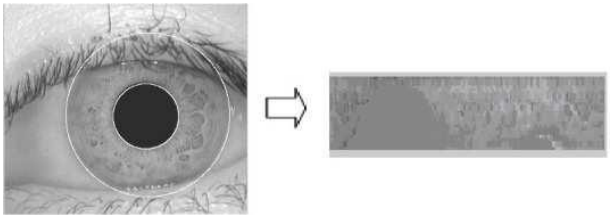

Fig. Iris normalized into polar coordinates.

Feature Extraction

The significant feature of an iris image should be encoded and a bit pattern should be created. This bit pattern is termed as iris template. This iris template that is generated in the feature encoding process will need a corresponding matching metric to measure the similarity between two templates. 1-D log gabor filter is used for feature encoding.

1-D Log Gabor Filter

The normalized iris pattern is convolved with 1D Log-Gabor wavelets to implement feature encoding process. The 2D normalized iris pattern is broken up into a number of 1D signals, then these 1D signals are convolved with 1D Gabor wavelets. The rows of the 2D normalized iris pattern are taken as the 1D signal, each row corresponds to a circular ring on the iris region. The output of filtering process is applied to a four levels phase quantization, with each level produces two bits of data for each phase. The phase quantization output is chosen to be in grey code to make two output differ by only 1 bit.

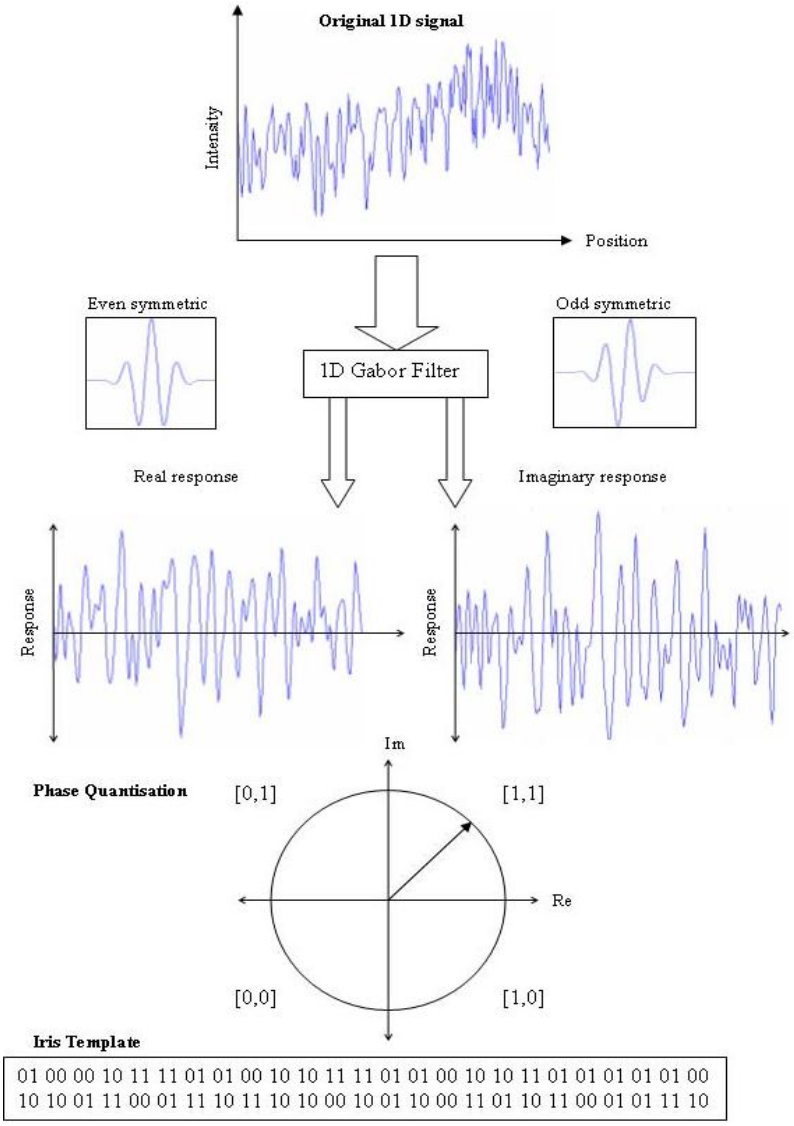

Fig. An illustration of the feature encoding process.

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III. RESULT

A database of 10 persons is created. Feature extraction is done by 1-D log gabor filter method. Significant feature of Iris image is extracted and iris template is created. Each iris template of the database has 20*480 bits. Each iris template has 20 rows and 480 columns i.e. 9600 bits. Each template has unique bit pattern which corresponds to unique individual.

Figure shows the iris pattern of 4 different persons. The area between two circles corresponds to the information which is extracted and is an actual iris part of a digital eye image. Rectangular black parts are noise corresponding to eyelids and eyelashes.

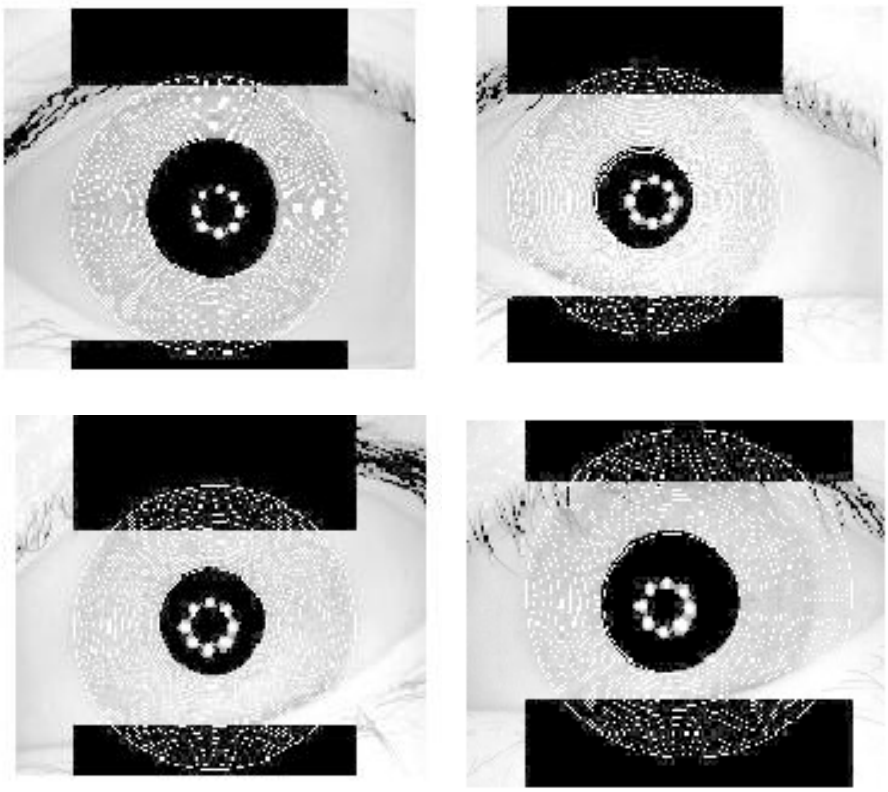

Fig. 2. Iris image as an output extraction process.

IV. CONCLUSION

In this paper we represented a brief idea of iris image feature extraction which is an important step of iris recognition system. We get different iris pattern for each person. So iris recognition system has an advantage that it is a reliable system for authentication and offers high security. In future work we will train and test created iris template and determine its recognition performance with HAMMING DISTANCE method.

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