AUTHENTICATION SYSTEM USING IRIS RECOGNITION

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Abstract

Biometric system provides automatic identification of an individual based on a unique feature or characteristic possessed by the individual. Iris Recognition is one of the important biometric recognition systems that identify people based on their eyes and iris. In this paper the iris recognition algorithm is implemented viz; hybrid technique and method of moments. In hybrid technique, the iris recognition algorithm is implemented using histogram equalization and wavelet techniques. The method of moments uses Fast Fourier Transform and moments. Here Phoneix database is used.

Introduction

Authentication is a fundamental issue to any trust oriented computing system and also a critical part in many security protocols. In addition, authentication also serves as the first step for many other security purposes, such as key management and secure group communication. Passwords or smartcards have been the most widely used authentication methods due to easy implementation and replacement; however memorizing a password or carrying a smartcard, or managing multiple passwords, smartcards for different systems is a significant overhead to users [1]. In addition, they are artificially associated with users and cannot truly identify individuals performing authentication is notoriously difficult.

Biometrics has been widely used and adopted as a promising authentication method due to its advantages over some existing methods. Biometrics refers to metrics related to human characteristics. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Fingerprints, voiceprints, retinal blood vessel patterns can be substituted instead of non-biometric methods for more safety and reliability [2]. Among these biometric characteristics, fingerprint needs physical contact and also can be captured or imitated. Voiceprint in like manner easily can be stored. These unique, measurable characteristics or traits of a human being for automatically recognizing or verifying identity are used in different devices.

This paper describes that among the various characteristics, iris recognition has attracted a lot of attention because it has various advantageous factors like greater speed, simplicity and accuracy compared to other biometric characteristics. Iris recognition relies on the unique patterns of the human iris to identify or verify the identity of an individual. Iris is distinct for every person, even the twins have different iris patterns and it remains same for whole of the life. Glasses or contact lenses do not interfere with the operation of iris recognition technology. Very few surgical procedures involve altering the iris, in which case re-enrollment in the database would be necessary. Blind people, as long as they have an iris present to scan, can likewise be identified with iris recognition technology. Section II describes about the block diagram of system. In section III implemented algorithms are discussed. Section IV focuses on results obtained.

Block Diagram

First user needs to enter user ID and respective password if it is correct then only he will allowed to go for next stage. In which IRIS is taken, if it matches with database then he will get authorized for the particular service.

Figure 1. Stages in IRIS recognition

Algorithms Implemented

A. Iris recognition using Hybrid technique

In this, iris recognition algorithm is implemented via histogram equalization and wavelet techniques. Iris recognition approach is implemented via many steps, these steps are concentrated on image capturing, enhancement, feature extraction, edge detection and matching. The implemented system gives adequate results different formats of iris images [3].

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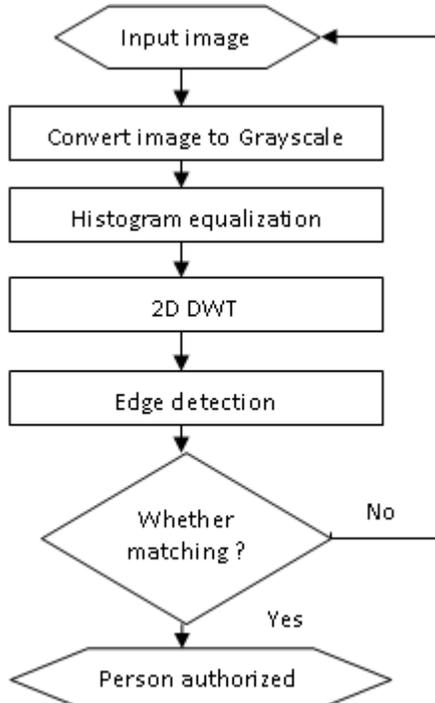
Figure 2. Flow chart of the hybrid technique

B. Iris recognition using Method of Moment
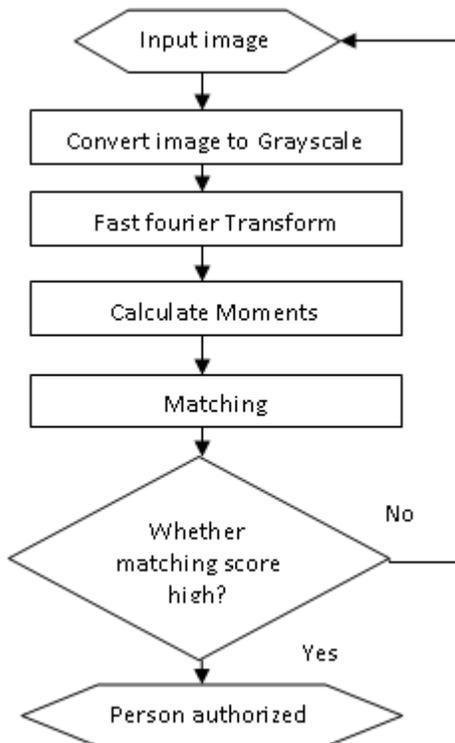
Figure 3. Flow chart of the method of moment

This is an efficient biometric algorithm for iris recognition using Fast Fourier Transform and Moments. The Fast Fourier Transform [4] converts image from spatial domain to frequency domain and also filters noise in the image giving more precise information. Moments are area descriptors used to characterize the shape and size of the image. The moments values are invariant to scale and orientation of the object under study, also insensitive to rotation and scale transformation [5]. At last Euclidean distance formula is used for image matching.

Results

A. Results for Hybrid technique

Below figures show the step by step output for the hybrid technique. Figure 4 indicates pre-processing performed on image using histogram technique, figure 5 gives 2 level DWT decomposition, figure 6 shows edge detection using Canny, figure 7 indicates the matching result.
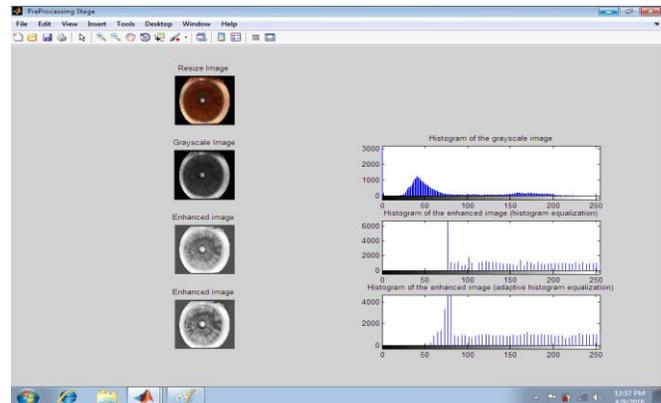
Figure 4. Result for pre-processing using histogram
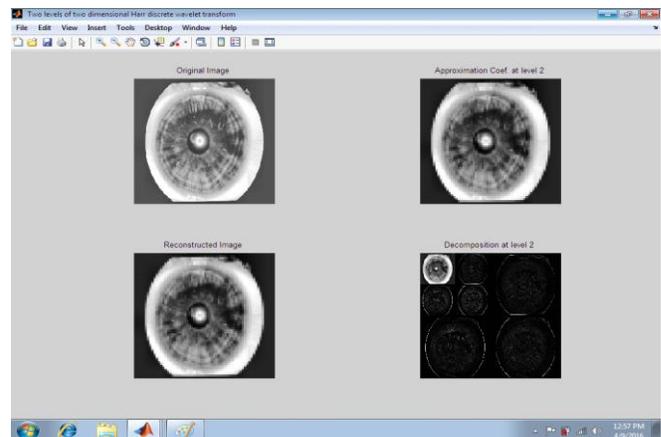
Figure 5. Result for 2 level DWT decomposition
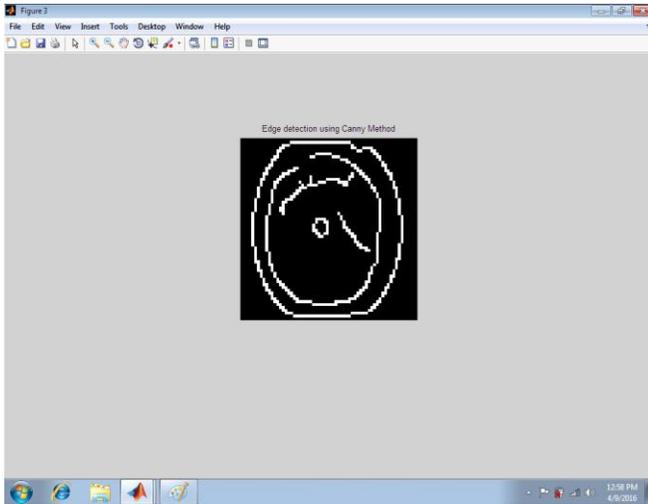
Figure 6. Result for edge detection using Canny
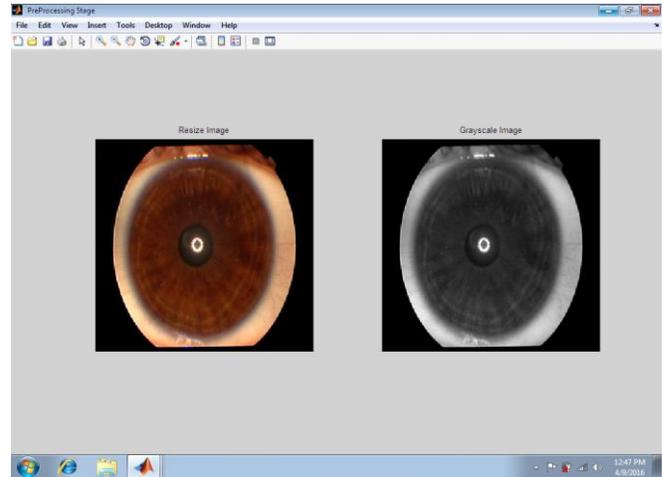
Figure 8. Result for Gray scale conversion
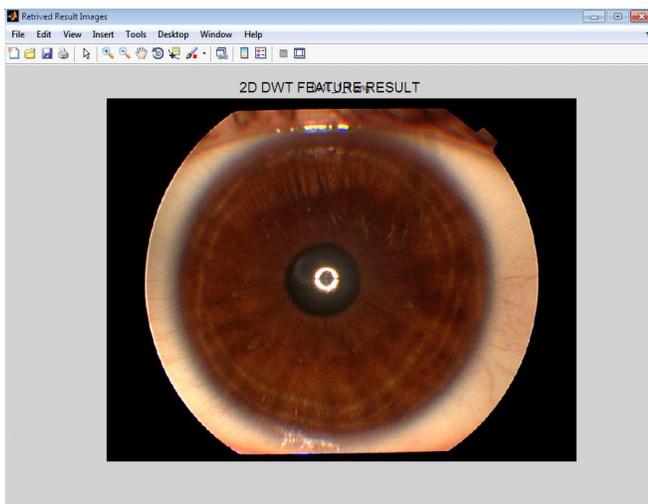
Figure 7. Result after matching
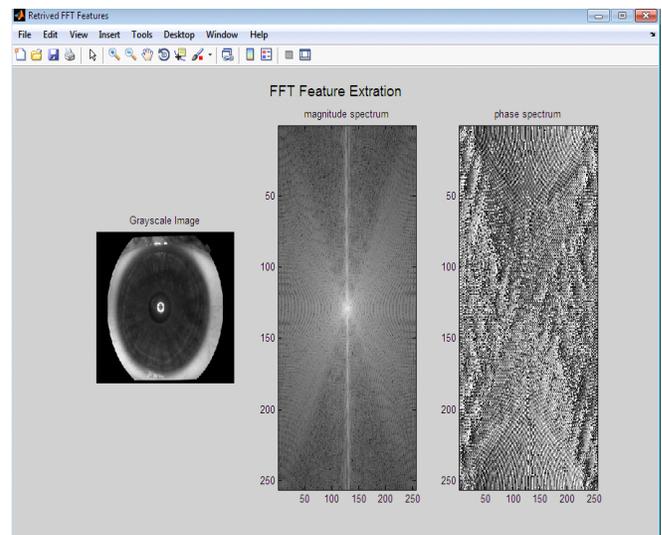
Figure 9. Result for FFT

B. Results for method of moment

Below figures show the step by step output for the method of moments technique. Figure 8 indicates Gray scale conversion, figure 9 describes FFT transformation, figure 10 shows matching result.
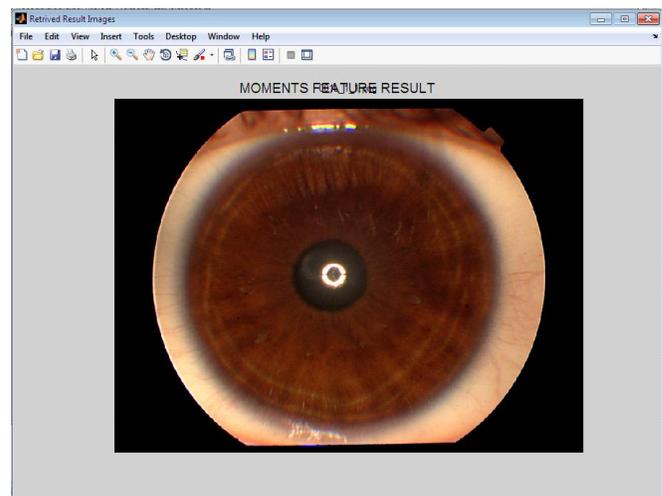
Figure 10. Result after matching

C. GUI for Iris Recognition

The first step is ID and Password authentication. Here the user will enter the user ID and password, if it is correct then it will go to the next step that is iris authentication. Here the image of iris of the person will be taken as input to the system and the features of the same will be calculated. Then those features are checked into the available database. And if the person is authorized he will be given further access. Figure 11 shows the interface for user to enter user ID and password.

Figure 11. GUI for login with ID and password

Figure 12 shows the interface for capturing the iris image also pre-processing and calculating its features. Then the calculated features are compared with available database. If the person's details are found in database the message is shown as 'authorized' otherwise shown as 'unauthorized' as shown in Figure 13.
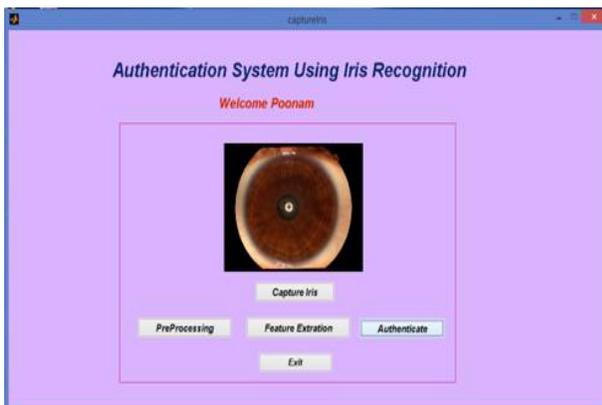
Figure 12. GUI for iris authentication by method of moments
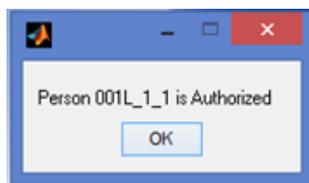
Figure 13. Matlab generated message box showing authorized person

Figure 14 indicates that if the person is authorized, the person's details are shown and he is allowed to proceed further.
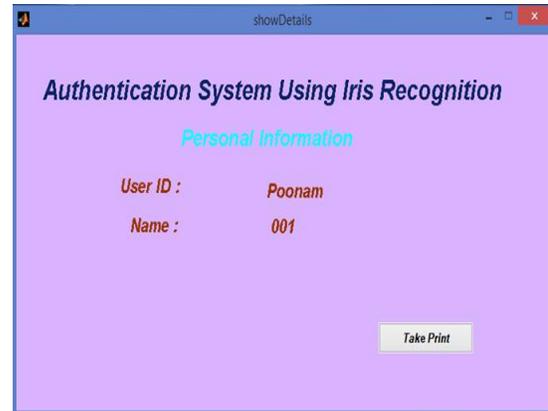
Figure 14. GUI showing details of user and allowing user to access further

D. Comparison of method of moments and hybrid technique

Comparing both the algorithms it is observed that the processing time taken by method of moments algorithm is less as compared to hybrid technique. But the size occupied by method of moments database is larger than the hybrid technique. Table 1 shows comparison of these two methods using 100 images database.

Table 1 Comparison of Hybrid and Method of Moment Techniques.

Parameters	Method of moment	Hybrid technique
Time required for evaluation	1.54 seconds[*]	2.189 seconds[*]
Size of database	133.79KB	79.39KB
Complexity	Less complex (Direct formulae are available)	More complex (Two level decomposition using DWT)

[*] estimated on Intel Core, 2.4GHz processor, 8GB RAM

Conclusion

Various algorithms have been used for iris recognition till date. In this paper, Iris recognition is done with the help of two algorithms viz; hybrid technique and method of

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moment. Both the algorithm gives high accuracy. But out of this two, method of moment gives results in less time and its computational method is less complex.

In the hybrid technique, first the image is enhanced using histogram and adaptive histogram technique. Then 2 Dimensional Discrete Wavelet Transform (DWT) is applied on image. In DWT technique the image is decomposed into 4 coefficients, viz; approximation, horizontal, vertical, diagonal. Here 2 level decomposition is done. In 2nd level the approximation coefficient is again decomposed into 4 sub-bands. Here the 2nd level approximation coefficient is used as feature vector. After that edge detection is performed on 2nd level approximation coefficient. For this canny operator is used because it gives better results than the other operators. And this part is used as feature. Then the matching is done using euclidean distance.

In the method of moment image first the Fast Fourier Transform is performed, which gives magnitude and phase of FFT. Then the moments are calculated, viz; zeroth order, first order, coordinates of centroid, inertia, normalized moments. The real part of fft and the moments are used as features of image. And then the matching is done using euclidean distance.

Time required by Method of Moments is 1.54 sec and memory required for database is 133.79 KB (for 100 images). For Hybrid technique time required is 2.189 sec and memory required is 79.39 KB (for 100 images). Method of moments is less complex than hybrid technique thus time required is less, but memory requirement is more. If there is no problem for memory storage then method of moments can be selected for iris recognition.

Further Work

Due to high cost of camera required for capturing the iris, here the images taken for iris authentication are from database. In real time application the iris image should be scanned by high definition camera. Further this can be implemented using camera. Also the algorithms and noise removal methods can be improved, so that the input image to the feature extraction stage could be made better which can improve the final outcome. Moreover the system should be tested on a larger database to validate the robustness of the system. As time required is more in case of Euclidean distance, the matching can be done by using some other distance. In future the 3D images can be tested to have more accuracy.

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