Biometric Identification System Using Human Eye

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Abstract

Multimodal biometric system combines the advantages of more than one biometric. Each biometric has advantages and disadvantages. This paper proposes a multimodal system using iris and sclera features as its input for identification purposes. The iris images captured are segmented and feature extracted using enhanced iris recognition system. Sclera poses challenge as it has multilayered vessel structure. Automatic segmentation and feature extraction method is deployed here for analysing the sclera. During registration the templates containing the essential features are stored in database. While identifying, the stored templates are retrieved from database and matched with the claimed identity. Fusion decision is taken while performing pattern matching. This system will prove effective where each of these biometric might fail individually.

Index Terms- Biometrics, Iris recognition, Sclera recognition, line descriptor, Identification

1.Introduction

Biometrics has been used for identification or recognition purposes. The physical, behavioural, biological traits of an individual can verify a person's identity. Physical traits include face, fingerprint, iris, and sclera. Behavioural traits are like gait, voice and biological include DNA. Each of these has its own advantages and disadvantages. Some traits could change over a period of time, cannot be used for recognition from a distance or can cause hygiene issues. A biometric may be more applicable in a particular scenario than the rest. No biometric is perfect or can be applied universally.

Biometric systems compared with traditional authentication schemes are more reliable and it is difficult to copy, share or distribute the biometric feature [1]. The biometric characteristics have the following requirements due to which they can be used in authentication schemes [2].

- *Universality*: each person should have the characteristic.
- *Distinctiveness*: any two persons should be sufficientlydifferent in terms of the characteristic.
- *Permanence*: the characteristic should be sufficientlyinvariant (with respect to the matching criterion) over aperiod of time.
- *Collectability*: the characteristic can be measured quantitatively.

A practical biometric system meets the specified recognition accuracy, speed, and resource requirements. Commonly used biometrics are DNA, ear, face, gait, hand geometry, fingerprint, iris, signature, keystroke, voice, odour, palm print, retinal scan[1]-[2]. Sometimes there can be biometric signal or representation variations due to following reasons[1].

i. Inconsistent presentation
ii. Irreproducible Presentation
iii. Imperfect signal

Biometric system can be used for verification, identification, screening purposes [1]-[2]. Four main modules commonly used in biometric systems are sensors, feature extraction, matcher, and system database. Applications of these systems arecommercial (E-Commerce, ATM, PDA), government (driver's license, social security), forensic (missing children, criminal investigation)[2].

Limitations of single biometric systems or systems using only one biometric feature are as follows[2].

- Noise in sensed data
- Intra class variance
- Distinctiveness
- Non universality
- Spoof attacks

2. Existing system

Among the different biometrics, iris provides great accuracy and reliability. Sclera is another biometric that is unique to each person. It can be used for human ID. Each of these has disadvantages as described in following sections. This makes the single biometric system fail to provide correct results.

A. Image Acquisition

The biometric iris shows high accuracy rates in recognition or identification scenarios. The iris recognition system gets input from image capture device. It has various features that can be taken into consideration like ridges, furrows, rings etc[3]. The clarity of the image is inversely proportional to distance between the person and the capture device or camera.This effect the feature extracted. The image obtained at a long distance will not be focussed to obtain the iris feature required for the ID system. Therefore this system will not provide ID at a distance.

B. Multilayered sclera

Sclera is the white portion of the eye. There are blood vessels in the sclera portion which can be used as feature for identification purposes. The blood vessel thickness will not be the same at all times. The blood vessel position with respect to the center of eye i.e. pupil will be the feature extracted and used for ID. This feature can be obtained from images at a long distance. Unlike iris this biometric can be used for ID at a distance[4]. This biometric too comes with its own disadvantages. Thevessel is multilayered and has complex nonlinear deformations.These challenges make extracting the sclera feature a complex operation. The use of this biometric alone can lead to a larger computation time.

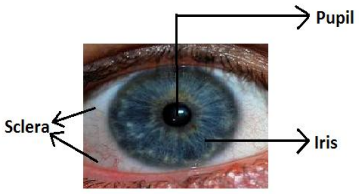

Fig 1. Image of eye

3. Proposed System

The proposed system combines iris and sclera recognition systems. Figure 1 shows the iris and sclera portions in human eye. The unique features of iris and sclera are both stored as templates in database for a particular individual. Then during identification or recognition process, the claimed identity's template value is checked with values already stored in the database. More the match score between the two, claimed identity is genuine and not an imposter. This system will also make sure that no false accept or false rejects take place. When image is not taken from a very close range, the value stored for iris would not be accurate and that of sclera will be more definite. So the sclera value is compared and as the person moves closer to camera, image captured at this distance can give iris recognition with more accuracy. So combining both the features will result in better performance of the ID system.

3.1 System Architecture

The fusion while using iris and sclera is done at the decision level.The iris and sclera is segmented and extracted. The resulting template is merged and stored in the database as part of the registration process. The system architecture is shown in fig 2. Image captured is

During identification, the feature extracted from the claimed identity is compared with the stored template. The stored template contains the iris and sclera feature of the individual. When an identity is claimed, the

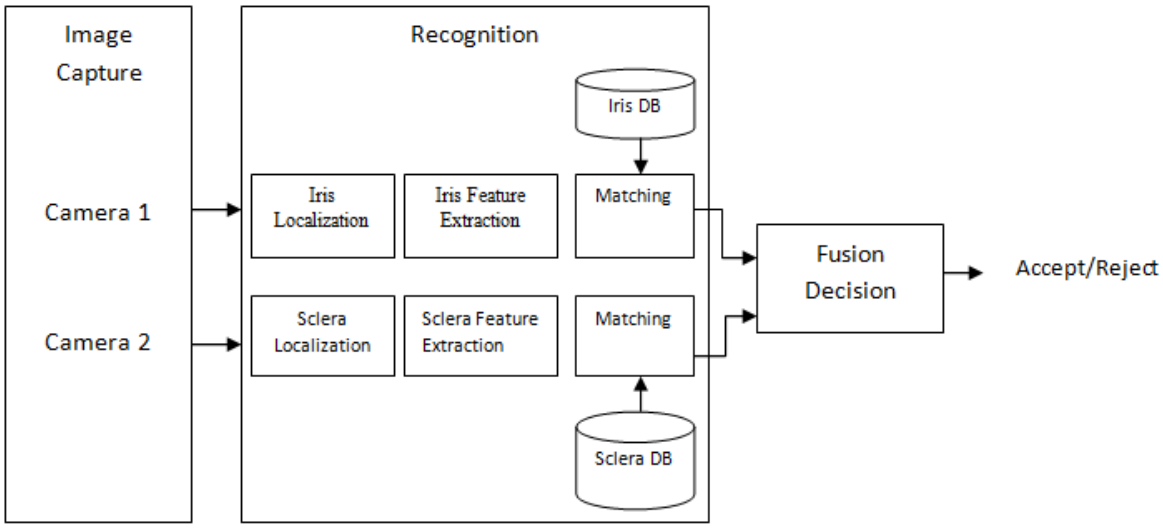

FIG 2. SYSTEM ARCHITECTURE

sclera feature that is claimed is first compared with the sclera feature of stored templates in the entire database. A new set of matching templates is then considered for the next comparison. If no such match is found, the person is not an authorized one. If a new set is formed then iris feature of claimed identity is compared with this set of templates. The matching algorithm is applied again and result is obtained. When there is no match the person could be unauthorized. Hamming distance between the templates is used as a measure of matching between the claimed identity and database template[5].

There will be a decision making algorithm at the decision making level. The sclera feature is first compared. The stored template and the claimed identity's sclera blood vessel pattern are compared and this gives a set of matches. Then iris feature is compared with new set of templates formed after the previous comparison. The resulting match will enable to identify person as imposter or not.

3.2 Algorithms

After obtaining the iris image, following algorithms are used for extracting the required feature and use it later for identification purposes.

1. **IRIS**

- **Segmentation of Iris**
  Algorithms used for segmentation are
  a. Enhanced pupil boundary detection algorithm
  b. Finding pupil center algorithm
  c. Detecting iris boundary algorithm
  d. Exclusion of eyelid and eyelash

- **Localisation**
  Algorithms that can be used are
  a. Hough transform{edge detection-wildes system}
  b. Integero differential operator{daugman method}

- **Normalisation**
  This is done for removing dimensional inconsistencies.

- **Image Enhancement**
  It is done by Histogram equalisation technique.

- **Feature Extraction**
  Phase information is the discriminating feature. It is obtained by using cumulative sum.

- **Pattern matching**
  Enhanced iris recognition system employs pattern matching algorithm that helps to reduce computational match time.

2. SCLERA

- **Segmentation**

  It is done by calculating the following.

  a. Estimate glare area
  b. Iris boundary detection
  c. Sclera area detection
  d. Refine eyelids and iris

- **Extraction**

  The blood vessels are considered as line segment and the segment position with respect to pupil center will be obtained by finding the segment descriptors.

- **Pattern Matching**

  Random sample consensus type algorithm is used to estimate the best fit parameters for registration between the two sclera vascular patterns. To avoid false accepts, patterns are registered as set of points. The points are the centers of line segments that make up the template. The registration can be considered optimum if the minimum distance between the templates is minimized.

4. Conclusion

The multimodal biometric system can combine the advantages of several biometric and result in producing higher recognition accuracy. Limitations of individual biometrics can be reduced to some extent by combining biometrics. This proposed system combines iris and sclera. This can be used for identification purposes.

The future enhancements to this system can be made by using algorithms that will reduce the computational time. If the task to be completed by the algorithm can be run in less time, the overall computational time can be reduced. The use of multiple biometrics generally will increase the calculating time. The choice of algorithms in such a case would determine the overall efficiency of system.

REFERENCES

1 A. K. Jain, A. Ross, and S. Pankanti, "Biometrics: A Tool for Information Security," IEEE Trans. Inf. Forensics Security, vol. 1, no. 2, pp. 125–143, Jun. 2006

2 A. K. Jain, A. Ross, and S. Prabhakar, "An Introduction to Biometric Recognition," IEEE Trans. Circuits Syst. Video Technol., vol. 14, no. 1, pp. 4-20, Jan. 2004.

3 R.P.Wildes, "Iris recognition: An Emerging Biometric Technology," Proc. IEEE, vol. 85, no. 9, pp. 1348–1363, Sep. 1997.

4 Zhi Zhou, Eliza Yingzi Du, N. Luke Thomas and Edward J. Delp ,"A New Human Identification Method: Sclera recognition", IEEE Trans. Syst, Man, A Cybern Part A: Syst. Humans, Vol. 42, No. 3, May 2012

5 G. O. Williams, "Iris Recognition Technology," IEEE Aerosp. Electron. Syst. Mag., vol. 12, no. 4, pp. 23–29, Apr. 1997. [10]

6 John Daugman,"New methods in Iris Recognition", IEEE Trans. Syst, Man, A Cybern Part B: Syst. Humans, Vol. 37, No. 5, Oct 2007

7 Zhaofeng He, Tieniu Tan, Zhenan Sun, XianchaoQiu, " Toward Accurate and Fast Iris Segmentation for Iris Biometrics", IEEE Trans. Pattern Analysis and Machine Intelligence, Vol.31, No.9, Sept 2009

8 J.Daugman, "How Iris Recognition Works", IEEE Trans, Circuits Syst. Video Technol, vol.14, no.1, pp. 21-30, Jan 2004

9 Jong-Gook Ko, Youn-Hee Gil, Jang-Hee Yoo, Kyo-Il Chung,"A Novel and Efficient Feature Extraction Method for Iris Recognition", ETRI Journal, Vol.29, no.3, June 2007.

10 Gaganpreet Kaur, Akshay Girdhar, Manvjeet Kaur, "Enhanced Iris Recognition System- An Integrated approach to Person Identification", International Journal of Computer Applications(0975-8887), vol. 8, no.1, Oct 2010.

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