Iris as Biometric Technique- A Review

Dr. Nidhi Srivastava

Information Technology, Amity University, India

Abstract :*Iris recognition is an effective and efficient technique which is being used nowadays for security reason. Many researchers have worked towards this. And many of them have proposed different framework and algorithms to improve upon this recognition technique. This paper discusses about the various stages involved in iris recognition and the benefits and various applications where is it being used.*
Keywords -biometrics,feature extraction, iris recognition, pre processing, template matching

----

I.   INTRODUCTION

In today's world security of the data has become very crucial. With Government moving towards the digital India to remove corruption and making things online for an easy, simple and fast transaction more and more efforts are being made for safe and secure transaction. The initial protection methods like passwords, personal ID cards, magnetic cards, keys etc. are not much reliable today and the security has been breached a lot many times. To make the systems more reliable biometric technology is being used. This has been introduced way back, but still much needs to be done. The biometric trait of a person is unique and no two persons not even the twins have the same biometric traits. The biometric traits are of two types based on physiological and behavioral traits. The physiological traits include fingerprint, face, iris, hand etc. and the behavioral trait includes keystroke patterns, signature, voice etc. These biometric features can provide security in various sector of industries like retails, banking, mobile phone, etc. [1, 2]

This paper is divided into five sections. Section I gives the Introduction of the Biometrics and iris as biometrics. Section II lists the benefit of iris over other biometric techniques. Section III gives the various stages of the iris recognition. Section IV lists the various application areas where iris as biometric technique is being used and Section V finally gives the conclusion.

II.   BENEFITS OF IRIS AS BIOMETRIC

Many biometric techniques like fingerprint scanning face recognition, etc. are available. But, in the past few years Iris recognition has gained a lot of importance and is considered to be a better choice in comparison to the other traits due to the benefits as given below [1,3,4]:

1. Uniqueness- It is the quality of the iris that it is different for different persons. Even identical twins have different iris patterns. The pattern in the iris gets developed at the age of 10 months and it does not change in the entire lifetime of the person. The iris texture is formed with many small characteristics like freckles, coronas, stripes, furrows, crypts which vary from person to person and so it is unique and different for each person.
2. Reliability and stability over time – Iris pattern is very stable and it does not change with the change in time. Thus, the reliability of iris is very high. The iris pattern does not get changed even if one puts on glasses or contact lenses. Even the surgery of the eye does not affect the iris pattern. Iris is well protected against damage also as it has a thin shield of membrane, the cornea, which protects it.
3. Ease of collection- Storing of iris database does not require too much of space as the size of iris image is very small. So the search speed in a large database is very fast and also accurate.
4. Non-invasive– Iris scan can be done from 10cm to few meters away. This makes iris scanning hygienic as contrast to the fingerprint scanners where one needs to touch the scanner to record the fingerprint.

III.   STAGES OF IRIS RECOGNITION

There are different stages in the iris recognition. These are shown in the fig.1 given below. Also, each of the phase has been described below in detail [5,6,7,8,9,10,11]
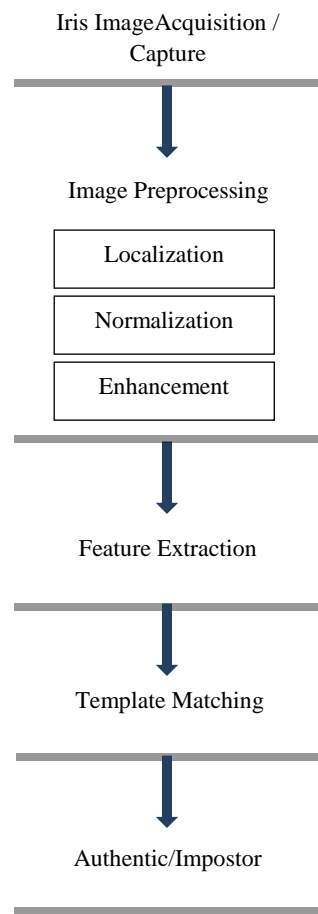
Iris ImageAcquisition /
Capture

Image Preprocessing

| Localization |
| Normalization |
| Enhancement |

Feature Extraction

Template Matching

Authentic/Impostor

Figure 1:Stages of Iris Recognition

Image Acquisition/Capture: This is the first step in which the image of the iris is captured using a camera or sensors.

Image Preprocessing: Image preprocessing comprises of three stages: localization, normalization and enhancement. Iris localization includes pupil detection, iris boundary detection, eyelid detection and eyelash detection. Iris boundary is identified by detecting both the inner and outer boundary of the iris, though the two circles are not concentric. This segments or isolates the iris from the rest of the eye. Many algorithms have been used for segmentation of the iris. The upper and lower eyelids and eyelashes generally cover a part of the iris and so full iris is not visible. So it is necessary to remove the portion of eyelid and eyelashes which cover the iris, so that proper iris can be detected. Many algorithms are given which are used for localizing the iris. Some of these algorithms widely used are Integro-differential operator, Hough transform, Discrete Circular Active Contour, Bisection method and Black hole search method.

Next normalization of the iris is done. This step is important because the Cartesian coordinates of the iris image is converted to Polar coordinates under Iris normalization. The main function of the iris is to control the amount of light going into the eye by dilating or contracting pupil, which is a small opening in iris. The acquisition of iris image is done in different lighting conditions and distance. The radial size of the pupil varies due to variation in the illumination. So, normalization process is necessary as it reduces the effect of the illumination variation and the two different images of same iris which have same characteristic features at the same spatial location are easily recognizable. Normalization thus compensates for the variations and help in the later stages of feature matching and normalization.

Image enhancement is applied on the normalized image to enhance the features of the iris. It compensates for the low contrast and non-uniform illumination.

Feature Extraction: Iris of a person contains certain special and unique features which makes the iris different for different persons. These features include freckles, stripes, coronas, etc. Using various algorithms these features of the iris are extracted which are used in the next step.

Template Matching: In this the features extracted from the above step are compared with the features of the iris data stored in the database and matching of the iris is done.

Authentic/Impostor: Based on the template matching the person is identified as authentic or impostor. If the input iris matches with the already stored iris database then the person is said to be authentic else the person is a fake one.

IV. LITERATURE REVIEW

Much research work has been done in iris recognition for making it an effective and efficient method of biometrics. Different techniques and algorithms have been used by the researchers for segmentation, localization, normalization or matching. Some of the works done by the authors are listed below. Various techniques used for different stages or phases by each of the author are also mentioned:

In [12] the authors have isolated the pupil boundary using a new thresholding method. The method is based on eye color map. The authors tested the technique on CASIA database of iris images. Accuracy obtained on using the above technique on this database is 100%.

In [13] the authors have used Canny edge detection for segmentation. For feature extraction Hough transform technique have been used. Finally, Hamming Distance has been used as matching technique. Experimental results show that the proposed algorithm has an encouraging performance.

[14] have proposed a framework for iris recognition in the noisy environment. First the iris pre-processing is done so as to remove the noise in the image. Then, for feature extraction combined approach of LBP and GLCM has been used. For recognition two neural networks based classifiers-radial basis kernel and probabilistic neural network has been used. The system was tested on CASIA and MMU database. Experimental results show that the system performance is good. In fact 96.5% recognition rate is achieved when PNN classifier is used for MMU dataset.

In [15] the authors have given a new algorithm for localizing the iris. Firstly, morphological operations was applied on the iris image, then Daugman's IDO method was used for detection of pupil and finally modified Daugman's IDO was used for detecting iris outer boundary. CASIA database was used for testing this method. Results show that method is 99.3% accurate.

In [16] for locating iris boundaries RANSAC (Random Sample Consensus) and ellipse fitting method were used. For iris normalization, the authors have used Daugman's rubber sheet model. Finally for matching templates PSR(Peak Side Lobe Ratio) was used. Experiment was conducted on WUV database. Results showed that the iris localization technique used in the paper is high. The detection of the iris inner boundary is 99% accurate and detection of iris boundary is 98% accurate.

In [17] the authors have used preprocessing technique Contrast Limited Adaptive Histogram Equalization (CLAHE) for enhancing the image of the iris. Authors have used circular hough transform technique for segmentation. For extracting the features Scale Invariant Feature Transform (SIFT) has been used. Finally for matching, the fusion rule has been applied.The method was found to be very accurate.

V. APPLICATIONS

Iris recognition finds its way in many areas. Some of the applications where it is being widely used are [18]:

1. Bank ATM – Iris recognition in ATMs can be really beneficial as the user will not have to keep the ATM card handy and remember the PIN. Thus user will also be free from the hassle of keeping the card/pin safely so that it does not get lost or stolen.
2. Airport Security – Iris recognition technology on airports can help in hands free airport access. If the database of iris has the data of a particular person then they can immigrate without passport or without any other identity proof as iris recognition is more than enough. Also, the crew members can easily and quickly gain access to the secure air-side with such recognition. Iris recognition will thus help in secure, easy, convenient, accurate, efficient and faster airport access.
3. Healthcare facility – Iris recognition will prevent patient from wrong identification, identity theft. No other person can claim the identity of any other person. Insurance policies and past insurance records for each patient can be linked to iris recognition. This will help the health care institutions in knowing in advance the financial risk associated with each patient even before their treatment begins.
4. Finance and banking – For many transactions the user needs to go to banks and wait in long queues for the

same. The bank official dealing with the customers spend most of the time in taking the same information and documents repetitively from the customers as identity proof. With iris recognition the officials will save their time and thus will get ample time to perform on other important banking and financial services.

VI.   Conclusion

For good safety of the data, biometric security is preferred over other security measures like password, card etc. In this paper I have highlighted the benefits of iris recognition and the various stages involved in iris recognition. Some of the work done by the researchers in this area has also been listed. Iris recognition because of its many benefits is nowadays being used in many application areas.

REFERENCES

[1]   Nivedita S. Sarode, A. M. Patil "Review of Iris Recognition: An evolving Biometrics Identification Technology", IJISME, Volume-2 Issue-10, September 2014

[2]   Richard Yew Fatt Ng, Yong HaurTay, Kai Ming Mok "A Review of Iris Recognition Algorithms" International Symposium on Information Technology, PP 1 – 7, Volume 2, 26-28 Aug. 2008

[3]   ArezouBanitalebiDehkordi, Syed A. R. Abu-Bakar, JurnalTeknolog, "A Review of Iris Recognition System"

[4]   http://www.irisid.com/productssolutions/technology-2/irisrecognitiontechnology/

[5]   TossyThomas,AnuGeorge,Dr.K P Indira Devi, "Effective Iris Recognition System", PP 464 – 472, RAEREST 2016

[6]   Ms. Sruthi.T.K, Ms. Jini.K.M "A Literature Review on Iris Segmentation Techniques for Iris Recognition Systems", IOSR Journal of Computer Engineering (IOSR-JCE) 8727 PP 46-50, Volume 11, Issue 1, May. - Jun. 2013,

[7]   Sonia Sangwan, Reena Rani "A Review on: Iris Recognition", ,IJARMET Vol. 1, Issue 1 Apr. - Jun. 2015

[8]   John Daugman "How Iris Recognition Works", IEEE Transactions on Circuits And Systems For Video Technology, Vol. 14, No. 1, January 2004

[9]   Z.ZainalAbidin, M.Manaf, A.S.Shibghatullah, S.H.A.MohdYunos, S.Anawar, Z.Ayop, "Iris Segmentation Analysis using Integro-Differential Operator and Hough Transform in Biometric System", Journal of Telecommunication, Electronic and Computer Engineering Vol. 4 No. 2 July - December 2012

[10]   A.Mallikarjuna, S. Madhuri, "Biometric Security Techniques For IRIS Recognition System",IJRCCTVol 2, Issue 8, August -2013

[11]   HimanshuSrivastava"Personal Identification Using Iris Recognition System, a Review", IJERA, pp.449-453,Vol. 3, Issue 3, May-Jun 2013,

[12]   Ali AbdAlmisreb, NooritawatiMdTahir, AdzroolIdzwan Ismail and Ramli Abdullah "Enhancement Pupil Isolation Method in Iris Recognition", IEEE International Conference on System Engineering and Technology

[13]   Nithyanandam.S, Gayathri.K.S , Priyadarshini P.L.K "A New IRIS Normalization Process For Recognition System With Cryptographic Techniques" , 2011

[14]   Kamal Hajari, UjwallaGawande, YogeshGolhar "Neural Network Approach to Iris Recognition in Noisy Environment", 2015

[15]   Vineet Kumar, AbhijitAsati, Anu Gupta "Iris Localization Based on Integro-Differential Operator for Unconstrained Infrared Iris Images", International Conference on Signal Processing, Computing and Control 2015

[16]   TossyThomas,AnuGeorge,Dr.K P Indira Devi, "Effective Iris Recognition System", Global Colloquium in Recent Advancement and Effectual Researches in Engineering, Science and Technology (RAEREST 2016)

[17]   HarinderKaur, Sunil Pathania "Image Enhancement and Iris Recognition using SIFT Feature Extraction".

[18]   Segun O. Olatinwo, O. Shoewu, OlusegunO.Omitola, "Iris Recognition Technology: Implementation, Application and security consideration", Pacific Journal of Science & Technology, pp 228-233, Vol. 14, No. 2, November 2013

[19]   https://www.bayometric.com/biometric-iris-recognition-application.