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The Literature survey on latest Iris Recognition Technique

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Abstract: With use of advanced image processing methods and tools, it becomes very easy to perform recognition and identification of humans using iris images. There are two main types of images such as Image Captured in Visible Light and Image Captured in NIR Lights. The iris technique is mostly used to human identification and recognition. In the iris recognition system use images are captured under NIR light. Hence identify such image parameters, curves and important location; it is required to automatic identification of human which can improve the identification and recognition of biometric machines. The image processing based methods are mainly three important phases such as image pre-processing, iris segmentation and feature extraction. This paper scope is limited to study on identification and recognition methods. In this paper, aim is to present the study on different recent techniques of human identification using biometric system and different approaches like 1-D DWT (Discrete Wavelet Transform) filter execution, matching and recognition and circular normalization. The outcome of this paper is to find the current research challenges based on study of different methods of iris recognition system through the comparative study of all recent methods studied.

Keywords: Iris, Image Captured in NIR Light, 1-D DWT Filter Execution.

INTRODUCTION

Recognition and Authentication of any individual person is becoming more important in past days. In the modern world where computers and electronics devices are more extensively used and the populace of the world is increasing, there is a need to provide high level authentication technology. Traditional techniques such as user name, passwords, keys, ID cards, token based systems are not useful for long time and secure in many of the security fields. In modern society raise importance of automatic and reliable authentication process. In now day's biometric identification system has proved to be more reliable means of identify the human identity. Biometric refers to a science of analyzing human physiological or behavioral feature for security intention and the word is comes from the Greek words bios means life and metrikos means measure. The Biometric features are not possible to faked, forged, guessed and stolen easily. There is no need to remember these biometric functions. Biometric identification techniques are used to inherent physical characteristics which are unique from all other people. In the behavioral biometrics uses voice, keystroke, gait etc., and in physiological biometrics uses fingerprint, face, palm print, iris, retina, ear, DNA etc to recognition.

Among the physiological biometrics, in human body iris is a very important part and it has the different of uniqueness and stability. Iris recognition technology is now a day's more advantageous in the field of information security and authentication of individuals person in the areas such as controlling access to security zones, verification of passengers at airports, stations, computer access at defense establishments, research company, data base access control in distributed systems etc. the iris recognition system is currently used in many countries to recognize missing children identification , national id cards , airline crews and airport staff.

In the image of iris is a visible color circle bounded by the pupil and white sclera, as shown below in Fig. 1. The size of the iris Different from person to person with a range of 10.2 to 13.0 mm in diameter, an average size of 12 mm in diameter, and a circumference of 37 mm.

The human eye is sensitive to visible light. Increasing illumination on the eye causes the pupil of the eye to contract, while decreasing illumination reason of pupil to extend. Visible light causes specular reflect to inside the iris ring.

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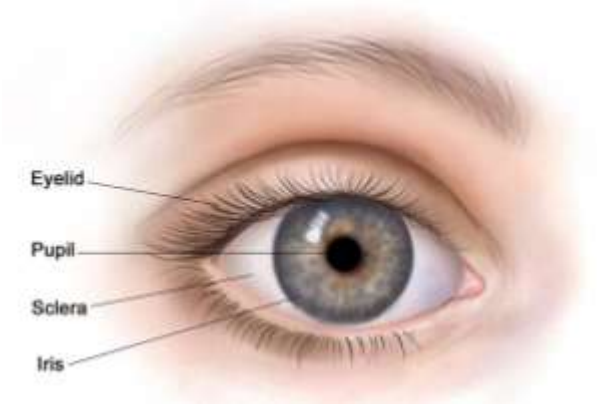

Fig.1. Example of the iris image

On the other hand, the human retina is less sensitive to near infra-red (NIR) radiation in the wavelength range from the 800 nm to 1400 nm, but iris detail can be still imaged with the NIR illumination. As the muscles surrounding a pupil contract or relax, the size of the pupil changes to regulate the couple of light entering into the eye. So, illumination variations shall be cause significant changes in pupil size. In the daily illumination environment, pupil diameter usually varies from to the 1.5mm to 7mm. As an output; the changes lead into iris deformation dramatically & introduce big intra-class difference. Thus, iris recognition under unrestricted illumination conditions is a highly challenging issue. Iris from different people captured in various sizes and distance is affected on the illumination in iris images. Like as elastic deformation into the iris texture will affect the matching results. Daugman represented the iris using a fixed parameter interval in a doubly dimensionless pseudo polar communicate system, normalized the iris in image of a fixed size. The normalization not only reduces to a certain extent the distortion of the iris caused by pupil movement but also simplifies subsequent processing.

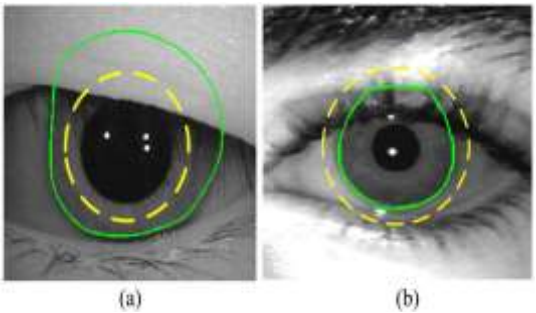

Fig.2. Example of Iris Circles

There are 3 classes of strategies to handle iris deformation. The image pre-processing, Daugman [5] projected to linearly stretch the circular iris space into a rectangle image. Yuan et. ale [14] represented the connection of iris albuminoidal fibbers between various iris sizes by using a meshwork model. Wei et al [13] applied a Gaussian perform to normalize deformation of iris texture nonlinearly. However, precise mathematical model of iris deformation doesn't exist. Even once image pre-processing, distorted iris pictures are still extremely different. Therefore the second quite strategies are to extract robust features. Sun et. ale [11] created use of qualitative iris texture illustration that is robust to deformation to a particular degree. Ortiz et ale [16] enforced dilation-aware enrolment to enhance recognition accuracy. To deal with significant deformation, robust matching strategies are often our third resort. It is Underneath into the Bayesian model. The approach in [8] calculable iris deformation as a bunch of hidden variables and designed a graph model. Though there are many distorted iris image matching ways, it remains a difficult issue & deserves additional study.

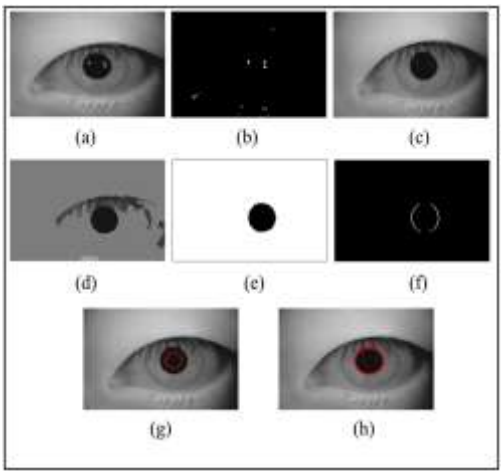

Fig.3. Example of Iris Segmentation and Pupil locations

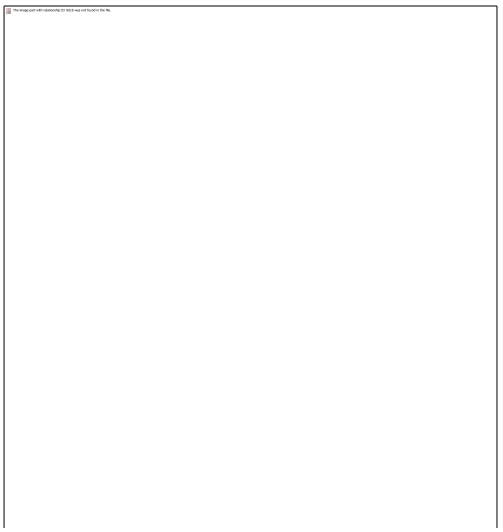

Fig.4. Example of Implementation Different Methods on Image

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STUDY ON METHODS

In this section, various techniques of Human Identification and Recognition using iris recognition system are discussed and analyzed. Basically we present study on Segmentation and Feature Extraction techniques.

Alice Nithya A. (2016)

In [1], author presenting Feature Extraction technique for improve the efficiency and accuracy of Human identification and recognition. The iris based biometric system is only one stable and reliable system compare to any other biometric system. In this paper biometric system of iris has various methods that are image segmentation, image normalization, image feature extraction and matching. It is plays an important role in improving the system performance, accuracy and reliability.

Maryam Soltanali Khalili. (2013)

In [2], author introduced approach for iris Recognition using Segmentation and Feature Extraction method. In last few years the iris becomes most important in the researchers. Researchers want to develop and provide appropriate solutions to ensure the counteraction of the system for error factors. In this research they try to use a mask to the image for removing unexpected factors affecting the location of the iris. Pupil localization will be faster and robust. And then it is easier to locate the exact location of the iris. For that use a simple method canny edge detector has been applied. Searching left and right iris edge point for detect the outer radius of iris. The extracting the feature of iris it is necessary to obtain the unique texture features of iris by using DSWT2 (discrete stationary wavelets transform 2 –D). Using DSWT2 tool and symlet4wavelet, distinctive features are extracted. The features are obtained to the application of the wavelet has been introduced and implement the feature selection procedure using similarity criteria.

Abhishek Verma. (2012)

In [3], a new iris recognition method based on a robust iris segmentation approach is presented by author for improving iris recognition performance. In this paper they use robust iris segmentation approach on power-low transformation to increase the accuracy of the pupil region, it is significantly reduces the people limbic boundary search region for increasing accuracy and efficiency in detection. The limbic circle has center with close range of the pupil center is detected. And approaches to improved iris recognition system.

T.Rajesh. (2016)

In [4], author introduced automatic identification of iris recognition system. It is compare the methods of automatic identification of iris recognition used in various stages. In it they study and compared many methods like iris image acquisition, segmentation, normalization, feature encoding and matching. In the segmentation stage and normalization stage the iris image is converted into standard format for manipulation, noise reduction by filtering transformation and process. The acquired image segmentation process remove that the iris image. The segmentation has number of resources which is required for describing large set of data which is selected and simplifies.

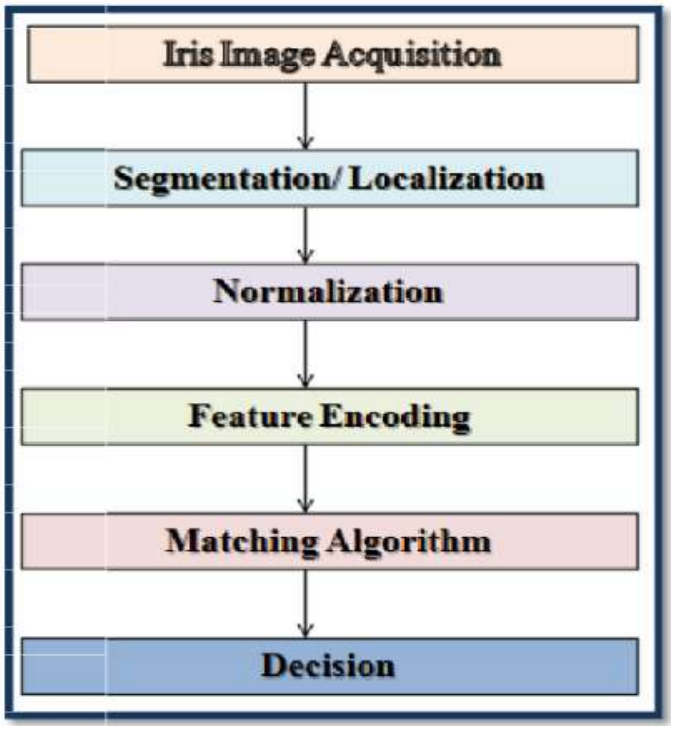

Fig.5. Iris Recognition System

Shaaban A. Sahmoud (2013)

In [5], author is conferred various technique for pupil segmentation with the use of CHT (Circular Hough remodel). Iris recognition systems have gained enhanced attention particularly in non-cooperative environments. One among the crucial steps within the iris recognition system is that the iris segmentation as a result of it considerably affects the accuracy of the feature extraction

and iris matching steps. Traditional iris segmentation ways give glorious results once iris pictures are captured with the use of close to infrared cameras below ideal imaging conditions; however the accuracy of those algorithms considerably decreases once the iris pictures are taken in visible wavelength below non-ideal imaging conditions. During this paper, a replaced formula is proposed to segments iris images captured in visible wavelength under unconstrained environments. The proposed algorithm reduces the error percentage even within the presence of kinds of noise embrace iris obstructions and specular reflection. The proposed formula starts with deciding the expected region of the iris with the use of the K-means cluster algorithm. The Circular Hough remodel (CHT) is then used in order to estimate the iris radius and centre. A recent efficient algorithm is developed to discover and isolate the higher eyelids. Then non-iris regions are removed. Results of applying the projected algorithm on UBIRIS iris image databases demonstrate that it improves the segmentation accuracy and time.

A. Radman. (2016)

In [6], author is Design a fast and reliable iris segmentation algorithm for less constrained iris images is essential to build a robust iris recognition system. Daugman's integrodifferential operator (IDO) is one of powerful iris segmentation mechanisms, but in contrast consumes a large portion of the computational time for localizing the rough position of the iris centre and eyelid boundaries. To solve this problem they implement the new and fast iris segmentation algorithm. The circular Gabor filter is used to find the exact positions of the pupil center. The iris and pupil circles are localized using the IDO taken into account that the real centers of the iris and pupil are in the small area around the rough position of the pupil centre. Extraction of upper and lower eyelid boundaries they use the live-wire technique. Experimental results demonstrate that the proposed iris segmentation algorithm significantly minimizes the required time to segment the iris without affecting the segmentation accuracy. The comparison results with iris segmentation algorithms show the accuracy and recognition performance of proposed algorithms. The UBIRIS, v1 iris image database is utilized to evaluate the performance of the proposed algorithm.

Lee Luan Ling. (2010)

In [7], author introduced Iris segmentation. In the iris recognition the iris segmentation is one of the crucial operations is involved. To increase accuracy of iris segmentation the success and precision of the subsequent feature extraction and recognition. Iris segmentation approaches uses in the require highly complex-exhaustive search and learning of many characteristics and parameters, which is avoid their effect real-time applications and makes the system highly sensitive to noise. In this paper they introduce the fast and efficient iris segmentation methodology to identify the simple solutions of these problems. It has three major procedures used in the proposed in iris segmentation approach, first is pupil detection, second is limbic boundary localization, third is eyelid and eyelash detection. It is carefully designed in order to prevent unnecessary and redundant image processing, and most importantly, to preserve the integrity of iris texture information. In this paper the proposed iris segmentation algorithm has following advantages and properties: (a) avoidance of complex geometric and mathematical modeling; (b) not necessary of a training phase for algorithm design and implementation; (c) guaranteeing real-time iris segmentation even for iris images with severe occlusions; (d) high accuracy in iris segmentation and therefore low segmentation error rate.

The proposed iris segmentation algorithms perform some well-known methods in both processing speed and accuracy. The iris recognition system that includes the proposed iris segmentation algorithm is capable for recognition performances comparable with those reported by other methods.

F. Jan (2014)

In [8], author is introducing the multi stage iris segmentation framework. A multi-stage iris segmentation framework for the localization of papillary and limbic boundaries of human eyes images. Instead of using time-consuming exhaustive search approaches, like traditional circular Hough Transform or Daugman's integrodifferential operator, an iterative approach is used. By decoupling coarse center detection and fine boundary localization, it increasing speed of processing and modular design can be achieved. This alleviates more sophisticated quality control and response during the segmentation process.

Avoiding the database –specific implementation, it is aims at supporting different sensors and light spectra, for visible wavelength and near infrared without parameter tuning. The system is evaluated by using multiple open iris databases and it is compared to existing classical approaches

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Maria Frucci. (2016)

In [9] the author uses approach a Watershed transform based Iris Recognition system (WIRE) for noisy images acquired in visible wavelength is presented. Key points of the system are: the color/illumination correction pre-processing step, which is crucial for darkly pigmented irises whose able do would be dominated by corneal specular reflections; the criteria used for the binarization of the watershed transform, leading to a preliminary segmentation which is refined by taking into account the watershed regions at least partially included in the best iris fitting circle; the introduction of a new cost function to score the circles detected as potentially delimiting limbos and pupil. Iris segmentation has a positive effect as regards the iris code, which results to be more accurately computed, so that also the performance of iris recognition is improved. Accessing the performance of WIRE and compare it with the performance of other available methods, and it uses the two well known databases. This is UBIRIS 1 and 2.

Alaa Hilal. (2012)

In [10], Author introduces Iris segmentation. It is considered as the most difficult and fundamental step in an iris recognition system. When iris boundaries are approximated by two circles, the methods are define more accurately the iris resulting better recognition result. In this paper we propose an iris segmentation method using Hough transform and active contour to detect a circular approximation of the outer iris boundary and to accurately segment the inner boundary in its real shape motivated by the fact that richer iris textures are closer to the pupil than to the sclera. The normalization, encoding and matching methods are implemented using Daugman's method. The Daugman's iris recognition system compared with CASIA-V3 iris image database to testing methods. Recognition performance is calculated in terms of accuracy, decidability, ROC curves and equal error rate. For better iris recognition system using our segmentation model.

comparative analysis

The methods are studied above and compared in terms of advantages, disadvantages, techniques and accuracy performance. Table 1 is showing the comparative study among these methods. And figure 6 is showing the accuracy comparison.

TABLE I COMPARATIVE STUDY OF IMAGE FORGERY DETECTION METHODS

Paper Title	**Key Techniques and Methods**	**Advantages**	**Disadvantages**
Feature Extraction Techniques for Recognition of IRIS Images	Iris Feature Extraction, Phase based methods, Zeros-crossing Representations, Key point descriptors, Intensity variation Analysis	Use phase based method and Feature Extraction method for obtain accuracy in recognition.	Processing Time is not evaluated.
A Robust IRIS Recognition Method on Adverse Conditions	IRIS recognition pupil edge detector wavelet	Find the Exact position of edges in Pupil and wavelet.	Less accuracy and processing time is not evaluate
Iris recognition based on robust iris segmentation and image enhancement	IRIS Segmentation, IRIS Recognition, power-law transformations, and Iris Challenge Evaluation (ICE).	Improve and Increasing detection accuracy and efficiency.	Processing time is not evaluated and very complex method
Performance Analysis of Iris Recognition System	Iris recognition system, Segmentation, Feature extraction, Matching algorithm	Working on Improving Accuracy.	Processing time is not evaluated.

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Efficient iris segmentation method in unconstrained environments	Biometrics; Iris recognition; Iris segmentation; Non-cooperative iris recognition; Eyelid localization	Having good Accuracy and A new efficient algorithm is developed to detect and isolate the upper eyelids	Processing time is not evaluated and uses old method to fond Pupil radius And Center.
Fast and Reliable IRIS Segmentation Algorithm	Daugman's integrodifferential operator (IDO), Iris segmentation algorithm.	Improve the Accuracy and implantation speed of Segmentation algorithm.	This is complex method and processing time is not evaluated.
Fast and Efficient Iris Image Segmentation	Iris segmentation, Iris recognition system, Biometrics, Image processing	Improve the Accuracy and implantation speed of image Segmentation.	No complementarily of the underlying classifiers.
Iris segmentation for visible wavelength and near infrared eye images	Iris biometrics, segmentation, is preprocessing.	Use a multi-stage iris segmentation framework for accuracy.	Complex method to implement
WIRE: Watershed based iris recognition	iris segmentation, iris detection, iris recognition, watershed transformation, Circle fitting.	Use different method to implementation	Processing time is not evaluated
Hough Transform and Active Contour for Enhanced Iris Segmentation	Iris segmentation, Biometric, Hough transform, Active contour.	Hough transforms and Active Contour is used to Accuracy.	Complex to implement

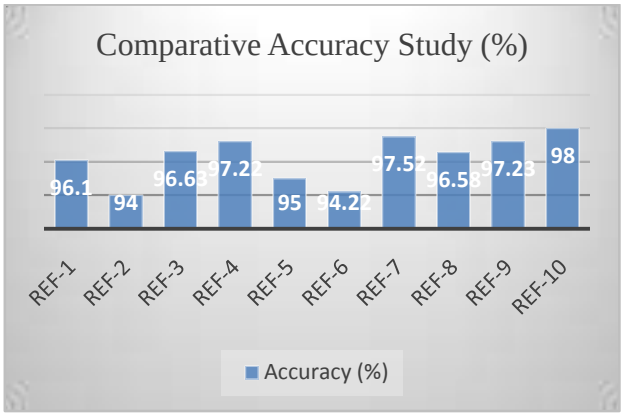

Fig.6. Accuracy Analysis of Studied Methods

Research problems

After studying the recent methods and comparing their performances, in this section the current limitations and research challenges are highlighted for future work. Working on IRIS Recognition is very essential now days, hence its must that method should be efficient and robust in all aspects. Recently many researchers did work to deliver the best solution to human identification in images, but we had below observations through our study:

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1. Most of existing methods are not consider and evaluated the processing time and obtain parameters.

2. The methods with best accuracy are having very complex procedure for Iris Recognition.

Some methods are designed and evaluated by considering on accuracy metrics while precision, recall and complexity are equally important for evaluation purpose.

CONCLUSION

In this paper, introduction to IRIS Recognition is presented and explained at first, and then importance of recognition of pupil on digital images is given. The different types of IRIS methods are explained. Basically this paper is aimed to present the study on all recent 2010 to 2016 IRIS Recognition methods. Section II and III, presented the detailed study on all recent techniques and compare them accuracy wise. Finally, the research limitations and problems have been pointed out in section IV. For future work, we suggest to work on addressing the current research problems.

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