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A REVIEW ON VARIOUS IRIS RECOGNITION TECHNIQUES IN BIOMETRICS

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ABSTRACT
The iris recognition is a kind of the biometrics technologies based on the physiological characteristics of human body, compared with the feature recognition based on the fingerprint, palm print, face and sound etc, the iris has some advantages such as uniqueness, stability, high recognition rate, and non infringing etc. The iris recognition consists of iris localization, normalization, encoding and comparison. Iris recognition is an automated method of biometric identification that uses mathematical pattern-recognition techniques. In this paper we have presented a review on various techniques in iris recognition.

KEYWORDS: Iris Recognition, Iris segmentation, Image Enhancement, Iris Encoding and Matching.

INTRODUCTION
Biometrics is defined as the unique (personal) physical/logical characteristics or traits of human body. These characteristics and traits are used to identify each human. Any details of the human body which differs from one human to other will be used as unique biometric data to serve as that person's unique identification (ID), such as: retinal, iris, fingerprint, and palm print and DNA. Biometric systems will collect and store this data in order to use it for verifying personal identity. The combination of biometric data systems and biometrics recognition/ identification technologies creates the biometric security systems biometric security system is a lock and capture mechanism to control access to specific data. In order to access the biometric security system, an individual will need to provide their unique characteristics or traits which will be matched to a database in the system. If there is a match, the locking system will provide access to the data for the user. The locking and capturing system will activate and record information of users who accessed the data. The relationship between the biometric and biometric security system is also known as the lock and key system. The biometrics security system is the lock and biometrics is the key to open that lock.

There are seven basic criteria for biometric security system:

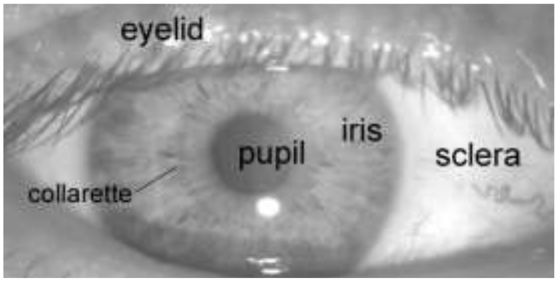
- Uniqueness
- Universality
- Permanence
- Collectability
- Performance
- Acceptability
- Circumvention.

IRIS INTRODUCTION
Iris recognition is a particular type of biometric system that can be used to reliably indentify a person by analysing the patterns found in the iris. The iris is so reliable as a form of identification because of the uniqueness of its pattern. Although there is a genetic influence, particularly on the iris' colour, the iris develops through folding of the tissue membrane and then degeneration (to create the pupil opening) which results in a random and unique iris.

In comparison to other visual recognition techniques, the iris has a great advantage in that there is huge variability of the pattern between individuals, meaning that large databases can be searched without finding any false matches [1].

This means that irides can be used to identify individuals rather than just confirm their given identity; a property that would be useful in a situation such as border control, where it might be important to not just show that an individual is not who they say they are but also to show exactly who they are.

The following diagram shows various parts of the human eye including iris :



The iris recognition process comprehends certain steps which are as follows :

- **Image segmentation:** Location and extraction of the iris segment on the image.
- **Noise detection:** Distinction between the iris pixels per se and all the distortions caused by external factors.
- **Image Enhancement**: Improvement of the iris image quality, as an attempt to compensate noise factors and optimize performance on upcoming operations.
- **Normalization**: Conversion of the segmented iris to a coordinates system able to deliver invariance to several factors.
- **Encoding and Matching:** Conversion of the iris data to a structure susceptible of a better corresponding, and the matching itself.

LITERATURE SURVEY

Sheeba Jeya Sophia S. et.al.[1], Iris recognition is a biometric system for access control that uses the most unique characteristic of the human body, the iris employed in automated border crossings, national ID systems, etc. This paper presents techniques to improve the performance of iris recognition system based on stationary images using NI Lab VIEW. Region of interest segmentation and localization of iris using canny edge detection is performed. And normalization of iris is performed using the Gabor filter. Local binary pattern (LBP) is used for feature vectors extraction and Learning Vector Quantization (LVQ) performs classification. Here, matching is performed using the hamming distance. Also we create a Lab VIEW database for storing the information of the users. All the images used in this paper were collected from the Chinese Academy of Sciences Insttitute of Automation (CASIA) iris database VI.0 with 108 subjects in it. **Gargi Amoli[2],** In this paper localisation of the inner and outer boundaries of the iris is done by finding the maximum blurred partial derivative. Normalization of iris has been achieved by projecting the original iris in a Cartesian coordinate system into a doubly dimensionless pseudopolar coordinate system. CASIA Iris Database has been used to test the algorithms. **Himanshu Srivastava [3]**, presents novel techniques developed to create an Iris Recognition System available. This paper proposes a personal identification using iris recognition system with the help of six major steps i.e. image acquisition, localization, Isolation, normalization, feature extraction and matching and also these six steps consists a numbers of minor steps to complete each step. The boundaries of the iris, as papillary and limbic boundary, are detected by using Canny Edge Detector & Circular Hough Transformation. We can use masking technique to isolate the iris image form the given eye image, this isolated iris image is transformed from Cartesian to polar co-ordinate. Now finally extract the unique features (feature vector) of the iris after enhancing the iris image and then perform matching process on iris code using Hamming Distance for acceptance and rejectance process. Her I am giving my review after studying a number of research papers and my proposed technique works very well and can be easily implemented. **Prateek Verma [4]** use Daughman's Algorithm segmentation method for Iris Recognition. Iris images are selected from the CASIA Database, then the iris and pupil boundary are detected from rest of the eye image, removing the noises. The segmented iris region was normalized to minimize the dimensional inconsistencies between iris regions by using Daugman's Rubber Sheet Model. Then the features of the iris were encoded by convolving the normalized iris region with 1D Log-Gabor filters and phase quantizing the output in order to produce a bit-wise biometric template. The Hamming distance was chosen as a matching metric, which gave the measure of how many bits disagreed between the templates of the iris.

IRIS RECOGNITION METHODS

Phase-based method

The phase based method recognize iris patterns based on phase information. Phase information is independent of imaging contrast and illumination. J.Daugman designed and patented the first complete, commercially available phase-based iris recognition system in 1994. The eye images with resolution of 80-130 pixels iris radius were captured with image focus assessment performed in real time. The representation of iris texture is binary coded by quantizing the phase response of a texture filter using quadrature 2D Gabor wavelets into four levels. Each pixel in the normalised iris pattern corresponds to two bits of data in the iris template. A total of 2,048 bits are calculated for the template, and an equal number of masking bits are generated in order to mask out corrupted regions within the iris. This creates a compact 256- byte template, which allows for storage and comparison of iris. The recognition in this method is the failure of a test of statistical independence involving degrees of freedom. Iris codes are different for two different samples. The test was performed using boolean XOR operator applied to 2048 bit phase vectors to encode any two iris patterns.

Texture-analysis based method

Wildes proposed iris recognition based on texture analysis. High quality iris images was captured using silicon intensified target camera coupled with a standard frame grabber and resolution of 512x480 pixels. The limbus and pupil are modeled with circular contours which is extended to upper and lower eyelids with parabolic arcs. The particular contour parameter values x, y and radius r are obtained by the voting of the edge points using Hough transformation. The largest number of edge points represents the contour of the iris. The Laplacian of Gaussian (LoG) is applied to the image at multiple scales and Laplacian pyramid is constructed. The matching is based on normalised correlation between the acquired and database images. Classification is performed using Fisher's linear discriminant function. The method for iris identification by Emine Krichen use a hybrid method for iris segmentation, Hough transform for outer iris boundary and integro differential operator for inner iris boundary. The iris code was produced using wavelet packets. The whole image is analyzed at different resolutions. 832 wavelets with 4 scales are used to generate 1664 bits code. The iris database consisted of 700 images acquired with visible light. An improvement of 2% FAR and 11.5% FRR was obtained relative to Daugman method. It was observed that by considering colour information, overall improvement of 2% to 10% was obtained according to threshold value.

Zero-Crosssing representation method

The method developed by Boles represents features of the iris at different resolution levels based on the wavelet transform zero-crossing. The algorithm is translation, rotation and scale invariant. The input images are processed to obtain a set of 1D signals and its zero crossing representation based on its dyadic wavelet transform. The wavelet function is the first derivative of the cubic spline. The centre and diameter of the iris is calculated from the edge-detected image. The virtual circles are constructed from the center and stored as circular buffers. The information extracted from any of the virtual circles is normalised to have same number of data points and a zero crossing representation is generated. The representation is periodic and independent from the starting point on iris virtual circles. These are stored in the database as iris signatures. The dissimilarity between the iris of the same eye images was smaller compared to the eye images of different eyes. The advantage of this function is that the amount of computation is reduced since the amount of zero crossings is less than the number of data points. But the drawback is that it requires the compared representations to have the same number of zero crossings at each resolution level.

Approach based on intensity variations

Iris recognition system developed by Li Ma is characterized by local intensity variations. The sharp variation points of iris patterns are recorded as features. In the iris localization phase, the centre coordinates of the pupil are estimated by image projections in horizontal and vertical directions. The exact parameters of the pupil and iris circles are calculated using Canny edge detection operator and Hough transform. The iris in cartesian coordinate system is projected into a doubly dimensionless pseudopolar coordinate system. The local spatial patterns in an iris consist of frequency and orientation information. Gabor filters are constructed to acquire frequency band in the spatial domain. Gabor functions are Gaussians modulated by circularly symmetric sinusoidal functions. The feature extraction begins by generating 1D intensity signals considering the information density in the angular direction. The 1D signal is represented using dyadic wavelet transform to obtain the feature vector. It decomposes the signal into detail components at different scales. The feature values are the mean and the average absolute deviation of the magnitude of each 8x8 block in the filtered image with the total number of blocks being 768. For dimensionality reduction, Fisher Linear Discriminant is used and for classification, nearest centre classifier is used. The similarity between the pair of feature vectors is calculated using the XOR operation. The circular shift-based matching is performed from which the minimum matching score is considered.

Approach using Independent Component Analysis

The iris recognition system developed by Ya-Ping Huang adopts Independent Component Analysis (ICA) to extract iris texture features. Image acquisition is performed at different illumination and noise levels. The iris localization is performed using integro differential operator and parabolic curve fitting. From the inner to outer boundary of iris, fixed number of concentric circles n with m samples on each circle is obtained. This is represented as a matrix n x m for a specific iris image which is invariant to rotation and size. The independent components are uncorrelated, determined from the feature coefficients. The feature coefficients are non-Gaussian and mutually independent. The basis function used is kurtosis. The independent components are estimated and encoded. The centre of each class is determined by competitive learning mechanism which is stored as the iris code for a person. The average Euclidean distance classifier is used to recognize iris patterns.

Iris authentication based on Continuous Dynamic Programming

The technique proposed by Radhika authenticates iris based on kinematic characteristics, acceleration. Pupil extraction begins by identifying the highest peak from the histogram which provides the threshold for lower intensity values of the eye image. All the connected components in sample eye image less than threshold intensity value are labeled. By selecting the maximum area component we arrive at pupil area of the eye. Normalized bounding rectangle is implemented using centre of pupil to crop iris. Continuous dynamic programming is used with the concept of comparing shape characteristics part wise. The acceleration plot is segmented and parts of acceleration curve are used to verify with input's acceleration curve. For iris samples, rate of change of gray level intensities within bounding box forms acceleration feature plot. The implementation is based the concept of accumulated minimum local distances between a reference template and input sample.

CONCLUSION AND FUTURE SCOPE

In this paper, we have present a review on variour Iris recognition techniques. An approach to reliable visual recognition of persons is achieved by iris patterns. The other approaches are based on discrete cosine transforms, corner detection and parametric template methods. In future, a system is to be developed to recognize the iris in an efficient time with high accuracy.

REFERENCES

[1] Sheeba Jeya Sophia S. et.al., Security system based on Iris recognition Research Journal of Engineering Vol. 2(3), 16-21, March (2013)
[2] Gargi Amoli et.al., Iris Preprocessing, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 6, June 2012 ISSN: 2277 128X
[3] Himanshu Srivastava, Personal Identification Using Iris Recognition System, a Review, Himanshu Srivastava / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622
[4] Prateek Verma et.al., DAUGHMAN"S ALGORITHM METHOD FOR IRIS RECOGNITION-A BIOMETRIC APPROACH, International Journal of Emerging Technology and Advanced Engineering,ISSN 2250-2459, Volume 2, Issue 6, June 2012
[5] W. Ketchantang, S. Derrode, S. Bourennane and L. Martin, "Video Pupil Tracking for Iris Based Identification", Advanced Concepts for Intelligent Vision Systems, LNCS 3708, pp. 1-8, 2005.
[6] Zhaofeng He, Tieniu Tan and Zhenan Sun, "Iris Localization via Pulling and Pushing", International Conference on Pattern Recognition, pp. 366 - 369, 2006.
[7] Mira J. and Mayer J., "Image feature extraction for application of biometric identification of iris: a morphological approach", IEEE Proc. XVI Brazilian Symposium on Computer Graphics and Image Processing, pp. 391- 398, 2003.
[8] Guodong Guo, Micheal J. Jones, "Iris extraction based on Intensity Gradient and Texture Difference", IEEE Workshop on Applications of Computer Vision, pp. 1-6, 2008.
[9] Proenca H, and Alexandre, L.A, "UBIRIS: a noisy iris image database", ICIAP 2005, International Conference on Image Analysis and Processing, pp. 970-977, 2005.
[10] Li Ma, Tieniu Tan, Yunhong Wang, Dexin Zhang, "Personal Identification based on Iris Texture Analysis", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol.25, No.12, pp. 1519 – 1533, 2003.
[11] Daugman J, "How iris recognition works", IEEE Transactions CSV, Vol.14, No.1, pp. 21-30, 2004.

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[12] J. Daugman, "High Confidence Visual Recognition by a test of Statistical Independence", IEEE Trans. Pattern Analysis and Machine Intelligence, Vol. 15, No.11, pp.1148-1161,1993.
[13] Xianchao Qui, Zhenan Sun and Tieniu Tan, "Learning Appearance primitives of iris images for ethnic classification", International Conference on Image Processing, pp. 405-408, 2007.
[14] Martin-Roche D., Sanchez-Avila C. and Sanchez-Reillo R., "Iris recognition for biometric identification using dyadic wavelet transform zero-crossing", IEEE Aerosp. Electron. Syst. Mag., Vol. 17, Issue 10, pp. 3-6, 2002
[15] Libor Masek, "Recognition of Human Iris Patterns for Biometric Identification", School of Computer Science and Soft Engineering, The University of Western Australia, 2003.
[16] Xiaomei Liu, Bowyer K.W., Flynn, P.J., "Experimental Evaluation of Iris Recognition", IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops, pp. 158-165, 2005.
[17] Karen Hollingsworth, Sarah Baker, Sarah Ring, Kevin W. Bowyer and Patrick J. Flynn, "Recent research results in iris biometrics", Proceedings of the SPIE, Vol. 7306, pp. 73061Y- 73061Y-10, 2009.