International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 3, Issue 2 (Mar-Apr 2015), PP. 148-151

A SURVEY ON IRIS RECOGNITION FOR AUTHENTICATION

Nirali M. Bhagwagar, Yagnik A. Rathod
Department of Computer Engineering
Sardar Vallabhbhai Patel Institute of Technology
Vasad-388306, Gujarat, India
niralibhagwagar@gmail.com, rathodyagnik@yahoo.com

***Abstract*—Iris recognition is a method of biometric identification. Biometric identification provides automatic recognition of an individual based on the unique feature of physiological characteristics or behavioral characteristic. Iris recognition is a method of recognizing a person by analyzing the iris pattern. This survey paper covers the different iris recognition techniques and methods.**

***Index Terms*—Biometric Identification, Behavioral Characteristics, Feature Extraction, Iris Recognition, Image Acquisition, Iris Segmentation, Iris Pattern, Normalization, Physiological Characteristics**

I. INTRODUCTION

In today's world security is becoming more and more important. Authentication plays a major role in security. Authentication is the process of verifying the claimed identity of a person. Authentication is a means of defense against intruders. There are of various types like authentication using username with password, using card and using biometric. Most commonly, username with password is used for authentication, but Password is easily carked or stolen because of human tendency to make password easy to remember and also note down the password so that there is no need to remember. Cards can be stolen and accessing by anyone. Therefore there is no way of knowing that the claimed person is the actual one. Biometric identification provides secure authentication of a person as biometric data can't be steal and duplicated. Biometric data is unique and permanently associated with a person.

Iris recognition is a method of biometric identification. Biometric identification provides automatic recognition of an individual based on the unique feature of physiological characteristics like fingerprints, DNA, palm, face, iris, vein and retina or behavioral characteristic like Handwriting, speech and signature.

Iris recognition is a method of recognizing a person by analyzing the iris pattern. Iris pattern are formed by six months after birth. Iris pattern remains stable after a year and remain the same for life time that means it does not have aging effect. Iris patterns of identical twins differ and a person's left and right eyes have different patterns as well. This distinguishes it from fingerprints or palm print, which can be difficult to recognize after years of certain types of manual labor. It is regarded as the most reliable biometric technology since iris is highly distinctive and robust.

Iris recognition consists of five basic modules:

- Image Acquisition: Obtains an image of the eye.
- Iris Segmentation: Localizes the iris's spatial extent by isolating it from other structures in its vicinity, such as the sclera, pupil, eyelids, and eyelashes.
- Normalization: A geometric normalization scheme to transform the segmented iris image from Cartesian coordinates to polar coordinates.
- Feature Extraction: The most discriminating information present in an iris pattern must be extracted.
- Matching: determines how closely the produced code matches the encoded features stored in the database.

Fig.1 Framework for Iris Recognition

The iris feature recording is referred as an enrolment process. The authentication system attempts to confirm an individual's claim identity by comparing a submitted sample to previously enrolled templates is referred as an identification process. A conceptual framework for iris recognition is illustrated in Figure1.

II. LITERATURE SURVEY

This section describes the studies which gives an idea about iris recognition.

A. *Accurate Iris Recognition At A Distance Using Stabilized Iris Encoding And Zernike Moments Phase Features[1]*

Chun-Wei Tan and Ajay Kumar presented a joint strategy that extract and combine both the global and localized iris features for accurate iris recognition from the distantly acquired face or eye images for both NIR and visible imaging, under less constrained environments. For image enhancement histogram and Binarisation are used and for coarse segmentation random walker algorithm is used. Global iris bit stabilization encoding and a localized ZMs phase-based encoding strategy is used to robustly recover the iris features. It determines the matching information from the local region pixels and for the features for global regions. Local region pixels are more tolerant to the distortion while global regions are stable. Finally hamming distance is used for iris feature similarity. The superiority of iris matching strategy is ascertained by providing comparison with several state-of-theart iris matching algorithms on three publicly available databases: UBIRIS.v2, FRGC, CASIA v4-distance. Despite the encouraging results obtained by the proposed iris matching strategy, further efforts are required to improve the matching accuracy, especially for the visible-light iris matching in order to make any inroads to the commercial applications. Also the time, cost and space complexity is very high of this methodology.

B. Efficient And Accurate At-A-Distance Iris Recognition Using Geometric Key Based Iris Encoding[2]

Chun-Wei Tan and Ajay Kumar presented a technique in which a geometric key which is a set of coordinated pair is used to deal with significant image variations and influence from multiple noise sources. Geometric key uniquely defines the encoding of the iris features from the localized iris region pixels. The iris encoding and matching strategy works for both localized and global iris region pixels. The localized iris encoding strategy has strength in better accommodating for the imaging variations, while the global iris encoding strategy has strength in effective encoding of less noisy iris region pixels. Geometrical information is utilized to provide efficient encoding from the local iris region pixels. Temples for iris encoding are in the form of binary so similarity can be easily measured using hamming distance. Experimental result shows the superiority of this method by providing comparison with several competing iris encoding and matching algorithms on three publicly available databases: UBIRIS.v2, FRGC, CASIA-v4-distance.

C. Iris Recognition Using Combined Support Vector Machine And Hamming Distance Approach[3]

Himanshu Rai and Anamika Yadav used circular hough transformation is used for segmentation. Parabolic hough transformation and trimmed median filter is used for eyelid detection. Haar wavelet and 1D Log gabor filter is used for feature extraction and for recognition of iris patterns using a combination of support vector machine and Hamming distance. There is no information about noise for haar decomposition feature vector and it is not suitable for hamming distance classification. 1D log gabor wavelet the feature vector is suitable for hamming distance but it is not well suited for SVM based classification. Based on extensive testing of different networks, combined SVM and Hamming distance based classification approach is finally selected as the combination of SVM and Hamming distance has a better recognition accuracy than using a single method. These are the reasons of applying two different feature extraction techniques and two classification techniques. Experimental result shows that the accuracy of the proposed method is excellent for the CASIA as well as for the Check image database in term of FAR and FRR.

D. Robust Iris Recognition Using Sparse Error Correction Model And Discriminative Dictionary Learning [4]

Yun Song, Wei Cao and Zunliang He presented an approach in which all the training images are concatenated as a dictionary and the iris recognition task is an optimization problem to seek a sparse representation of the test sample in terms of the dictionary and a sparse error correction is used to deal with gross and spatially localized errors. In order to compact the huge dictionary, we introduce a discriminative dictionary learning framework to reduce computational complexity. Experimental results on CASIA Iris Image Database V3.0 show that the methods achieve competitive performance in both recognition accuracy and efficiency.

E. Noncooperative Bovine Iris Recognition Via Sift[5]

Shengnan Sun, Shicai Yang and Lindu Zhao presented a method in which scale invariant feature transform (SIFT) and bag-of features are used for bovine images which are usually irregular with respect to inactive participant. To assess the accuracy of the proposed method, we use the combination method with Zhang's two step segmentation method and Daugman's [1] 2-D Gabor filters feature extraction method to carry out the comparison. First, region-based active contour is used to detect the inner boundary. SIFT method is applied to detect the key points in the iris image and points located in pupil region are removed. Then, feature vocabulary is constructed and histogram representation for each iris image is generated. Finally, histogram distance is used for label assigning and iris matching test by using different classifiers such as K-Nearest Neighbors (KNN), Approximate Nearest Neighbors (ANN) and multi-class SVM classifiers. Since similar SIFT descriptors will be assigned the same “visual” word due to SIFT quantization, the greater the number of SIFT descriptors that can be matched, the greater similarity between the histogram representation. Experimental results on SEU database of bovine iris show that it is effective for noncooperative iris recognition. As SIFT descriptor is time-consuming, our future work will focus on improving the performance.

F. Iris Recognition Using Possibilistic Fuzzy Matching On Local Features [6]

Chung-Chih Tsai, Heng-Yi Lin, Jinshiuh Taur and Chin-Wang Tao presented the possibilistic based fuzzy matching strategy employ nonlinear normalization model and effective iris segmentation method for accurate iris position and smooth curves of inner and outer boundaries. The FGCT method is then applied to extract a smooth curve of each boundary from the gradient images Gabor filter detect local feature point and generate a rotation-invariant descriptor for each detected point. Then, matching algorithm compute a similarity score for two sets of feature points from a pair of iris images. But for a fair comparison, each wrong segmented sample was corrected manually. The experimental results show that the performance of our system is better than those of the systems based on the local features.

G. Secure And Robust Iris Recognition Using Random Projections And Sparse Representations [7]

Jaishanker K. Pillai, Vishal M. Patel, Rama Chellappa, and Nalini K. Ratha presented a unified framework with random projections and sparse representations, in which quality measure handle segmentation errors and possible artifacts arise during iris and provide accurate matching without compromising security relative to iris biometrics. This method can easily extended to handle alignment variations and recognition from iris videos, for robust and accurate system. But it doesn’t prevent the compromise of sensitive biometric information of the users. The approach includes enhancements to privacy and security by providing ways to create cancelable iris templates. Results on ND Data Set and ICE 2005 data sets show significant benefits of the proposed approach.

H. Personal Identification Based On Iris Texture Analysis[8]

Li Ma, Tieniu Tan, Yunhong Wang and Dexin Zhang presented a new scheme for iris recognition from an image sequence is used. First review the quality of each image in the input sequence and select a clear iris image from such a sequence for subsequent recognition. A bank of spatial filters (Multi-channel Gabor filter), whose kernels are suitable for iris recognition, is then used to capture local characteristics of the iris so as to produce discriminating texture features. Experimental results show that the proposed method has an encouraging performance. In particular, a comparative study of existing methods for iris recognition is conducted on an iris image database including 2,255 sequences from 213 subjects. Conclusions based on such a comparison using a nonparametric statistical method (the bootstrap) provide useful information for further research.

III. COMPARATIVE ANALYSIS

This section covers the comparative study of image segmentation methods and feature extraction methods.

Table1. Comparative study of Image Segmentation Methods

No.	Method	Description	Advantages	Disadvantages
1	Random walker algorithm	It produces segmentation based on the separation of quantities defined at the nodes.	Simple to use, Easily handle flows around complicated boundaries	It is biased to avoid crossing object boundaries
2	Circular hough transform	Directly detects the object's edges using image global features and iris regions when a number of points that fall on the perimeter are known.	Tolerant to the presence of gaps in feature boundary descriptions, Relatively unaffected by image noise	Calculation is very large, Large amount of Storage, High cost in computation
3	Region based active contour	Use to edge detection based on deforming an initial contour towards the boundary of the object to be detected.	Self-adapting in their search, Used to track dynamic objects	Higher accuracies require longer computation time
4	Daugman's Integro-differential operator	Used for locating the circular iris and pupil regions, and also the arcs of the upper and lower eyelids.	Does not suffer from the thresholding problems	Fail where there is noise like reflection in the image
5	Canny edge detector	Used for detecting edges.	Detects edges, Low error rate	Sensitive to noise, Produce missing edges or extra edges on complex images

Table2. Comparative study of Feature Extraction Methods

No.	Method	Description	Advantages	Disadvantages
1	ZMs phase encoding	It is based on the orthogonal moments	Robust to noise, Minor variations, Rotation invariance, Minimum information redundancy	Computational complexity
2	Geometric key based iris encoding	Geometric key is for feature encoding	Fast and efficient encoding	Influenced by noise
3	Log-gabor filter	Extract the texture feature	Multi-resolution, Multi-orientation	Sensitive to noise
4	Scale invariant feature transform (SIFT)	Used to detect and describe local features in images	Robust to local affine distortion scale and rotational invariance	Fully affine transformation require additional steps

IV. CONCLUSION

Iris recognition is automatic identification of an individual that has been research interest for recent years. Through this paper we can study the relevant work done in this area. We discuss different iris segmentation and feature extraction methods each one having its own advantages and disadvantages. From this survey it is concluded that iris recognition for eye images which are acquired from a distance and under less constrained environments impose several problems, especially for the images acquired using visible imaging. Image quality degradation is usually undesirable in the visible illumination eye images acquired from such dynamic environments. Therefore the need is to develop iris recognition algorithm that can operate on iris images acquired under visible or near infrared illumination.

ACKNOWLEDGMENT

I have taken efforts in this survey. However, it would not have been possible without the kind support and help of many individuals. I would like to extend my sincere thanks to all of them. I wish to express my deep sense of gratitude to my Guide, Mr. Yagnik Rathod, Assistant Professor of Computer Engineering Department, SVIT for accepting my work. He has been a great source of inspiration and we thank him for him timely and able guidance in the conduct of my work and constant supervision as well as for providing necessary information regarding this work. I would like to express my gratitude towards my parents, Mrs. Bijal Talati, Head of the

Department and members of SVIT for their kind co-operation and encouragement which help me in this dissertation.

REFERENCES

[1] Chun-Wei Tan; Kumar, A., "Accurate Iris Recognition at a Distance Using Stabilized Iris Encoding and Zernike Moments Phase Features," Image Processing, IEEE Transactions on, vol.23, no.9, pp.3962,3974, Sept. 2014,doi: 10.1109/TIP.2014.2337714.

[2] Chun-Wei Tan, Ajay Kumar, "Efficient and Accurate at-a-distance Iris Recognition Using Geometric Key based Iris Encoding", IEEE Trans. Information Forensics and Security,2014.

[3] Himanshu Rai , Anamika Yadav, "Iris recognition using combined support vector machine and Hamming distance approach", Expert Systems with Applications Volume 41, Issue 2, 1 February 2014.

[4] Yun Song, Wei Cao, Zunliang He, "Robust iris recognition using sparse error correction model and discriminative dictionary learning", Neurocomputing Volume 137, 5 August 2014.

[5] Shengnan Sun, Shicai Yang, Lindu Zhao, "Noncooperative Bovine Iris Recognition via SIFT", Neurocomputing, Volume 120, 23 November 2013.

[6] Chung-Chih Tsai; Heng-Yi Lin; Jinshiuh Taur; Chin-Wang Tao, "Iris Recognition Using Possibilistic Fuzzy Matching on Local Features," Systems, Man, and Cybernetics, Part B: Cybernetics, IEEE Transactions on , vol.42, no.1, pp.150,162, Feb. 2012doi: 10.1109/TSMCB.2011.2163817.

[7] Pillai, J.K.; Patel, V.M.; Chellappa, R.; Ratha, N.K., "Secure and Robust Iris Recognition Using Random Projections and Sparse Representations," Pattern Analysis and Machine Intelligence, IEEE Transactions on , vol.33, no.9, pp.1877,1893, Sept. 2011 doi: 10.1109/TPAMI.2011.34.

[8] Li Ma; Tieniu Tan; Yunhong Wang; Dexin Zhang, "Personal identification based on iris texture analysis," Pattern Analysis and Machine Intelligence, IEEE Transactions on , vol.25, no.12, pp.1519,1533, Dec. 2003 doi: 10.1109/TPAMI.2003.1251145.

[9] http://en.wikipedia.org/wiki/Iris_recognition.