Iris Recognition Methods of a Blinked Eye in Nonideal Condition

Abstract: Iris accuracy stands highest by Comparing of all the biometrics. This paper proposed methods for iris edge detection, extraction of feature and matching whereas the important condition is that eye is partially closed or eye is blinked. Due to occlusion effect present in n iris image, most images are incapable to maintain false rejection and acceptance ratio. To solve this issue, various methods are highlighted in this paper. Canny operator is used in the segmentation for separate edges of iris from non-iris part. To detect iris properties, K-out-of-n and Euclidian distance methods are used. This is possible to assess the result by using database CASIA v2.0. The experimental work is performed and accuracy up to 95 % is achieved. Genuine images give out with good accuracy which can be used in security related applications. Hence system is executed for superior function of security, robustness and accuracy.

Index Terms: Half-Iris recognition, Biometric system , partial eye, Security.

INTRODUCTION

Biometric system is defined as unique characteristics to identify as an individual. It consists of human's uniqueness identification using physiological or behavioral traits. Biological data can be measured using biometric system. Physiological unique data can be identified using face, DNA, fingerprints, retina, hand geometry and palm prints whereas biological is related to data human behavior. This highly unique biometrics ensures special identity of individuals. The goal of biometrics is to recognize individuals using above biometrics by their behavioral and physiological characteristics. Among all these biometrics iris recognition is the most accurate approach because of the most interpersonal reliable identity. Iris has highest stability and uniqueness. Hence is used in recognition for guaranteed solution for security. A diaphragm like structure which is located in between pupil and sclera in an eye is Iris. It is trabecular meshwork joint with connective elastic tissues. At the tenth month of gestation, iris is formed and remains same through the entire life. Hence it is stable organ which is visible externally from the body. Every individual has irises in different color and size. Two irises of a person cannot be same as it has high uniqueness. The shape and the size cannot be changed due to characteristics of stability. Iris has isolation and protection from the external world as it has data-rich physical structure. Next to DNA, Iris identifies a genuine uniqueness between individual characters. Security needs uniqueness and stability as two promising factors hence it is well used in security applications. In modern technologies, the basic problem relate to the security to control authenticated data and to access it on secured places. Traditional methods for security are keys and password. They are not suitable because it can be easily stolen. These issues can be addressed by using recent authentication systems. Recently, a new technique for secured high promising data is using biometrics for identification. Among those methods, iris recognition system is the reliable for authenticate check. In this Project CASIA database version 2.0 is used. CASIA Iris Image Database Version 2.0 (CASIA-IrisV2) consists of two subsets captured with two different devices that is, developed OKI Iris pass-h and our self-developed device CASIA-IrisCamV2.

Each subset includes 1200 images from 60 classes. Digital image processing has been presented by few surveys of iris recognition methods. It mainly focuses on outline of the popular methods used for different techniques of iris recognition. This comparison of methods is based on different performance and attributes. Lin Ma et.al. highlights on studying different geometrical structures in the iris changes. Poursaberi et.al.focuses on different segmentation of an iris based system. In this paper wavelet based texture features are used. They have got 99.31% accuracy in promising performance. Zhi Zhou et.al. proposed new technique of testing in-house database in recognition algorithms and its evaluation using a commercialized system. This work overcomes on traditional methods of iris recognition in Nonideal situations. It takes into consideration the effect of quality image as well as accuracy of segmentation. Aly I.Deoky et.al. proposed a algorithm for template fusion of a given iris image in iris recognition to get a most consistent feature data. They mainly worked out on data storage and accelerated matching processes. Karen Hollingsworth et.al. presented a fragile bit distance called a metric, which measure quantitatively the fragile bit patterns in two ideal iris templates. A beneficial information can be achieved from the fragile bit. They have also explained technique to improve accuracy by coincidence fragile bit locations. Amol D. Rahulkar et.al. proposed a method of feature extraction and post classifier in order to shift, scale and rotation-invarient technique in iris recognition to improve accuracy and speed. They have formulated a new algorithm of THFB wavelet form for feature extraction and k-out-of-n postclassifier to get high accuracy and less matching time. They have got accuracy 97.96% on CASIA database. Abduljalil Radman et.al. proposed algorithms for segmentation process to accelerate the process by using traditional methods of circular Hough transform and Integrodifferential operator to improve accuracy. Qian chen et.al. proposed Iris-Eyelid separability filter using a particular filter by tracking iris in a monocular video sequence. Izem Hamouchene et.al. proposed a new method of novel feature extraction method using neighborhood-based binary pattern. They have obtained a binary matrix which is considered as a encoded binary code of an iris. John Daugman is having a very important role in iris recognition. Daugman proposed a sophisticated method of developing iris patterns for recognizing persons which has been tested in many application areas like laboratory trials by giving out no false data matching over a million caparison tests. They have got the result over 9.1 millions comparison in irises of an eye. Xiao Zhou Chen at.al. explains a method of matching iris and its sample iris images with unified noise over the large data.

Main conclusion of this survey is to be familiar with different iris recognition techniques. To get easy understanding of total framework of all feature extraction, segmentation and matching processes. From review study of all mention methods, we can plan the proposed methods accordingly. Performance of proposed method can be estimated with respect to all earlier methods. If the traditional method is not suitable to implement then it can be replaced by alternative solutions. Hence, selected methods for designing new recognition system contains new strategies by comparing different recognition approaches. This paper mainly explains methods on iris recognition when eye is half closed. The rest of the paper is presented as follows;

Section 2 highlights the methodologies used for half iris recognition; Section 3 gives results and conclusion.

SYSTEM OVERVIEW

Iris recognition system for a half iris is different than normal eye that is nonideal condition. First step belongs to enrollment that is capturing of an image of person's eye. Second step is to segment an iris image. This is just to separate out the iris part from other noniris part. Step three involved iris pattern extraction and scaling to predefined size. Next step extract the features by using filtering process. The whole system is divided into two modes of operations which are training mode and testing mode. In the training mode, segmentation followed by extraction and matching is done on the image. This processed image is stores in the database. In the testing mode, template is created and as a reference. This reference template then matched with other templates. Last step involves matching of an iris image at training phase with the image at database. These steps are shown schematically in block diagram as shown below:

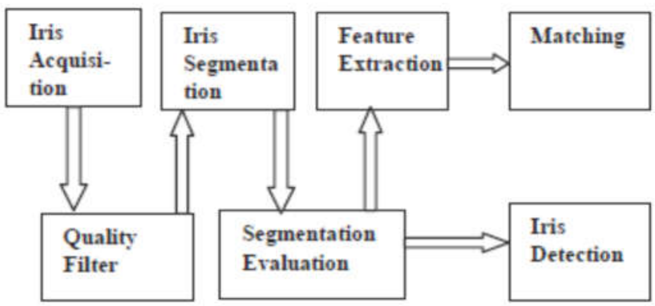
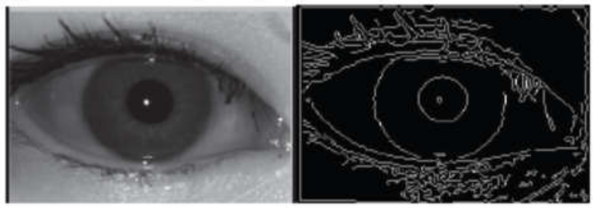


Fig.1 Block diagram of the system

Here objective of the above system is to test uniqueness between two templates. Among them, first template include processed image which is been captured at enrollment stage. The second template belongs to an image captured at the real time matching process by the camera and processed. Once two templates matched, system generates a matching score and identification process gets completed. This statistical score is used to calculate accuracy and other parameters. Like this, similar images can be tested and recognized in robust conditions.

Iris Segmentation

Iris segmentation can be done using methods like Daugman's Integro-differential operator, Edge detector using Hough transforms and Canny operator. The specific iris part is getting separated from occluded eye region. Occlusion includes upper eyelid, lower eyelid, pupillary region and some part of eyelashes which creates image noise. Hence these artifacts are successfully removed by segmentation for subsequent recognition. Segmentation results in separating inner and outer boundaries for detecting the exact iris region. Canny operator is promising method in segmentation. Grayscale image is taken as input and output comes out as edges of binary mapped image. Then gradient map of every image pixel is done by blur image operation. Under non-maximal suppression stage, value sets to 0 if gradient value is higher than neighboring sets. Last step involves extension of edge or non-edge to its predefined values by hysteresis process. If in case amplitude gradient is higher than the lower threshold, those pixels extend to its neighbors recursively. Segmentation results in detecting edges with the threshold values. The same results are shown in the below figure 2. In that figure 2 (a) shows original logical image whereas figure 2 (b) shows edge detected image after segmentation.



(a) (b)

Fig. 2 (a) Original image (b) Segmented image

Feature Extraction

The process in which features that means relevant information is extracted from segmented image is known as feature extraction. This information can be in the form of mean, standard deviation of pixels, contrast, edges of the images. The common methods for this process are Gabor filter; wavelet transforms. If we go for direct comparison then it may cause error. Hence Daugman uses 2-D Gabor filter by convolution. Coefficients of an image can be easily extracted and encoded image into texture information. Finally stores the result in separate rows and columns. Main complex domain is divided into four phases. Each phase is represented by two binary bits. After feature extraction by Gabor filtering, image converts into the complex matrix. For each complex feature, two binary bits hR and hI for value h is used at each pixel locations. Hence, binary phase pairs from an entire image get combined into the template of binary feature. This template is next used for pattern matching and decision making.

Pattern matching

Finding similarities between two iris images is done in pattern matching. In our system, two prominent methods are used. Previously processed image is been matched by Euclidian distance as well as k-out-of-n classifier. Unknown image is classified in multifeature space by minimum distance classifier in which image data gets minimizes. Index values of similarities are defined when minimum and maximum similarities are identical. Similarity index can be calculated by one of the method known as Euclidian distance. When two classes differ from each other, this classifier is applied.

$$d_k^2 = (X - \mu_k)^t \,.\, (X - \mu_k)$$

In the case of different variance, distance is defined as follows,

$$d_k^2 = (X - \mu_k)^t \,.\, \sigma_k^{-1} .\, (X - \mu_k)$$

It is require minimizing the computation dissimilarities threshold by using k-out-of-n classifier. Extracted features and comparison using partially closed iris is obtained. In training data sets, part 1 and 3 are excluded. In order to improve the performance multiple ROC's are fused together by using classifier. Those regions are 1,3 and 5. While testing phase, iris is accepted from k = 1,3,5 from n regions where $k \leq n$. Using following equations, we made an exhaustive search for threshold T in [0, 1] interval, testing all the possible combinations for the three thresholds values with 10^{-3} precision.

Computation of FAR:

$$FAR = \prod_{i=1}^{3} \frac{C(D_i^E > Ti)}{N}, k = 1$$

Where total number of intraclass comparisons is N. Computation of FRR:

$$FRR = \prod_{i=1}^{3} \frac{C(HD_i^I > Ti)}{M}, k = 1$$

Where total number of interclass comparisons is M.

Experiment Results

CASIA database v2.0 is used to evaluate the system performance in terms of percentage accuracy. In the evaluation process, three images from each person have been taken as a reference and four as a test. In the experimentation of the proposed methods, 25 persons have been taken randomly. Thus total100 images are taken in a testing phase as test data. Each image taken goes under preprocessing. Even though eye is partially closed, we can extract the exact edge from the image of an iris by segmentation process used in the system. This process followed by a feature extraction in which extracted information from the reference images is stored in the database. The obtained statistical data is sorted out by classifying most similar to dissimilar queries. All these procedure results in the percentage accuracy of the matching rate between iris images. The result is compared with some images which has been taken live. FAR and FRR is calculated by the k-out-of-n classifier. The proposed system has 95% accuracy when tested on CASIA V2.0 database. We can notice from the given result that classical given proposed system is convinient to use for the blinked eye. Probablities of error is also calculated at the matching stage by Euclidian distance. Error probability comes very low that is almost all iris templates match by Euclidian distance in matching stage. Following chart shows the result table 1:

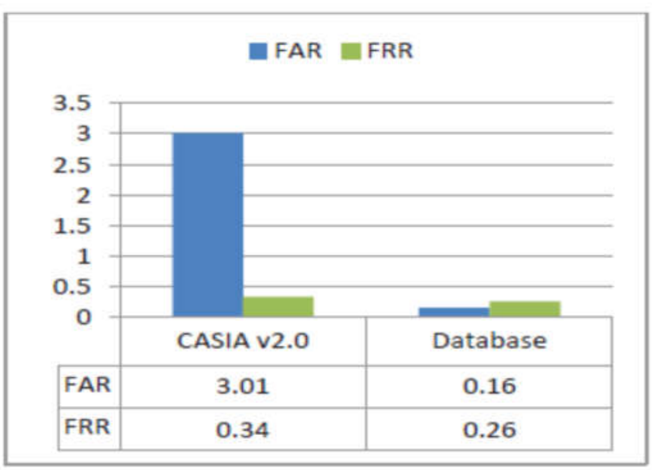


Fig.3: Result of FAR and FRR

As shown in the above Figure, two results are compared for CASIA database images and some images directly taken with camera. System robustness is tested by experiment result which demonstrate that given results in the present of half-closed images. As our experiments report, noisy data is extracted from which isolates the correspondent signature, extracted from the iris region that contains it. This decreases the probability that noisy iris regions corrupt the whole biometric signature when extracting the lower frequency components of the signal. Hence by this method false rejection rates in the iris recognition noisy images decreases significantly. Since isolation with the corresponding signatures from the noisy data which is extracted from the contaminated iris images.

Conclusion

In this paper, we have seen methods used for iris recognition in half closed eye or partially closed eye. This system uses latest methods of iris recognition for a blinked eye. CASIA database v2.0 is is used for the experimentation. The resuted accuracy comes out 95% on the CASIA database. The resulted FAR and FRR finds probability of false image acceptance and false image rejection. Matching ratio is displayed using Euclidean distance which has come almost 99%. Now we can summarize the proposed method acts suitably in the iris recognition. In the future work, we will give emphasis on increasing accuracy overall and creating algorithms to test robustess of the system.

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L.HARI HARA BRAHMA, M.Tech(Ph.D),

ASSISTANT PROFESSOR,

DEPARTMENT OF ECE,

KUPPAM ENGINEERING COLLEGE

KUPPAM

CHITTOOR(DT)

NAME : ANILKUMAR P

QUALIFICATION : MTECH

DESIGNATION : ASSISTANT PROFESSOR

WORKING AT PRESENT : MOTHER THERESA INSTITUTE OF ENGINEERING AND TECHNOLOGY, PALAMANER

DISTRICT : CHITTOOR