ELSEVIER

CrossMark

Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 89 (2016) 850 – 855

Procedia Computer Science

Twelfth International Multi-Conference on Information Processing-2016 (IMCIP-2016)

Human Iris Recognition for Clean Electoral Process in India by Creating a Fraud Free Voter Registration List

Parthasarathi De* and Dibyendu Ghoshal

National Institute of Technology, Agartala 799 046

Abstract

Human Iris pattern matching and recognition system is considered to be the best biometric identification found so far because of the unique features found in the iris and moreover the textured patterns of iris remain stable, invariant and distinct throughout the whole life. Iris recognition techniques involve a mathematical analysis of the unique stable patterns that are structured within the iris and then the comparison is being done with an already existing database. In this paper the implementation of creating a fraud free voter ID list is being done as to make a clean Electoral environment. For this localization of Iris and Pupils are done by canny edge detection algorithm, Normalization is done by Dougman's Normalization method and feature extraction is being done using Log Gabor Filter and lastly method of matching is accomplished by Euclidian distance[1,2]. MATLAB 2011 version is used for developing the present study, and much of the emphasis is given on software for Recognition of Irises in an efficient manner.

Peer-review under responsibility of organizing committee of the Organizing Committee of IMCIP-2016

Keywords: Biometric; Feature Extraction; Normalization; Pattern Matching.

1. Introduction

Different works on Iris Recognition and matching of Iris Pattern has been done before which consists of John Dougman Iris Code[1]. In his studies Hough Transform and Rubber Sheet model was introduced for an accurate and effective recognition of Iris system. Wildes and his team used Iris Image analysis by Laplacian pyramid. Boashas and Boles used the method of zero crossing with function that are dissimilar of bits for the performance of Matching[3]. Li Ma *et al.* use Gabor filter and certain Special filters. Kong and Zhang used Iris segmentation and their study was based on curvature fitting for segmentation of eyelashes, eyelids and various reflections[1,2]. Ping Huang at el uses basic function for training set by independent component Analysis. Libor Masek study on iris recognition system was based on a programmed division framework that is based on the Hough change, and can limit the round iris, reducing the unwanted portion by removing certain noises discarding eyelids and eyelashes, and light reflections. The extracted iris locale was then done normalization into a shape of rectangle area with consistent measurements to represent imaging incompatibilities. Fancourt *et al.* proposed an algorithm for recognition process for a distance to camera at a higher rate. Ahmad M. Sarhan Research of Recognition of Irises was based on Discrete Cosine Transform and

*Corresponding author. Tel.: +91 -9436767185.
E-mail address: parthasarathide76@gmail.com.

Peer-review under responsibility of organizing committee of the Organizing Committee of IMCIP-2016
doi:10.1016/j.procs.2016.06.071

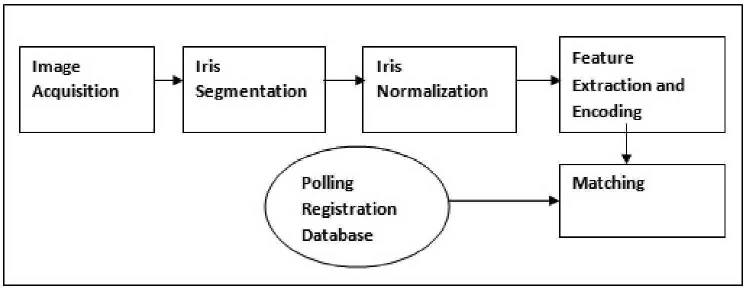

Fig. 1. Voter Registration List Based on Iris Recognition.

Artificial Neural Networks. As there is a need of unique features for individual identification in the formation of voter registration list Iris recognition is applied which will be matched again at the time of polling.

This process is done with 5 stages given below:

- Iris Acquisition
- Iris Segmentation
- Iris Normalization
- Feature Extraction
- Matching.

2. The Stages of Iris Recognition for Voter Registration List

2.1 Image acquisition

The capturing of high quality eye image is called acquisition. The quality of the eye image should be very high. Good resolution and clarity of eye image will lead to a better recognition rate. Noises such as illumination should be removed in case of Eye image capturing which may lead to reflections and blur of the image[1–3].

2.2 Iris segmentation

The Image acquisition step does not only capture the image of the Iris part of the eye which is my area of Interest in this paper. So Iris segmentation must be carried out as to discard the noises that are present in the image such as eyelash, eyebrows and cornea. So for feature extraction of the process it is very much crucial to localize the area of the eye image that consist of only the Iris[1,2].

2.2.1 Boundary detection by Canny edge detection algorithm

The Canny edge detection algorithm is very much important as it identifies the edges of the image with gradient points. This algorithm is applied to locate the boundaries of Pupil and Iris Contours prior to finding the centre of pupil[4].

First of all smoothing technique is used to discard the noise from the indistinct images so as to enhance the quality of the image so that analysis can be done with the best quality image of the Iris. Now from this gradient points need to be determined of each pixel by applying Sobel operator. Presently surmise the inclination esteem in the X and Y direction as needs be by applying the bit. The Gradient magnitudes can be determined by the equation given below

$$|G| = \sqrt{G_{X^2} + G_{Y^2}}$$

where G_x represents the gradient in X direction and G_y shown in equation reflects the gradient in Y direction respectively[4]. Gradient magnitudes find out the edges with respect to image. The direction of edges should be clearly determined for a better image to be analyzed. It is shown by the equation.

2.2.2 Double thresholding techniques and edge tracking

By saving all the maxima in the inclination picture and erasing all others picture honing is finished by evacuating the obscure edges. The most grounded edges can be spoken to by utilizing the limit process. For this twofold edge procedure is utilized and edge pixel more grounded than the edge are set apart to be solid and pixels lower than limit are thought to be low and are shrouded in light of the fact that some edges are genuine edge in the picture and because of harsh surface some may bring about clamour. Shrewd edge location calculation gives:

- Good recognition – the calculation ought to check however many genuine edges in the picture as could be allowed.
- Good limitation – edges checked needs to be as close as could be allowed to the edge in the original picture.
- Minimal reaction – a given edge in the picture must be checked just once, and where conceivable, picture commotion shall not make false edges. With this stride edges will acquired with Pupils and iris limits individually.

2.2.3 Detection of pupil and radius of iris

The Iris centre can be identified by analyzing the shift vectors of the chords. Radius can be calculated by having a close look at both side of a chord and their lengths and width are compared. The centre was shifted by this vector which equals two components of the chord. With the help of this two different offset vectors can be calculated[1,3,4].

2.3 Iris normalization

The normalization of Iris is done to avoid imaging incompatibilities so that under any situation or environment the image captured by camera suits for Recognition[1,9]. Normalization is actually done to standardise the image of Iris for Future matching due to various parameters like insufficient light, distance to camera, quality of picture taken. Keeping in mind the end goal to dodge these variables and obtain more compelling rate of Recognition for the Normalization of Iris picture is executed as appeared in Fig. 3 underneath.

Standardized picture after upgrade is proficient here by a grid plan and represented to as dim level estimations of the iris picture. This matrix formed behaves as the bit patterns so as to make easier for matching by Euclidean distance.

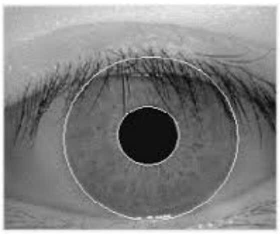

Fig. 2. Pupil and Iris Contour Boundary.

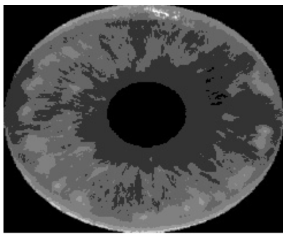

Fig. 3. Segmented Portion and Normalized Image of Iris.

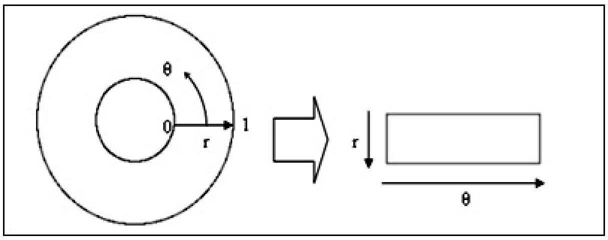

Fig. 4. Unwrapping of the Iris.

The round iris portion is changed into a rectangular area with an altered size and measurement after Iris confinement[1–3]. With limits recognized, the iris locale is standardized from Cartesian directions to polar directions. This is represented by the mathematical statement below.

$$\boxed{\begin{array}{l} \theta_\varepsilon[0, 2\Pi], r_e[R_p, R_l, (\theta)] \\ x_i = x_p + r \cdot \cos(\theta) \\ y_i = y_p + r \cdot \sin(\theta) \end{array}}$$

(x_i, y_i) represents the area between the directions of the pupillary and limbic limits in the heading θ. (x_p, y_p) shown in the equation represents the inside direction of the understudy, Rp is the radius of the pupil, and $R_L(\theta)$ is the separation between focal point of the understudy and the purpose of limbic limit. For a superior quality picture upgrade is done to enhance the brilliance and complexity of the picture. The Iris picture after Normalizing gives essential surface examples which are unmistakable and special. After this the critical components of irises are taken and encoded with the goal that it is anything but difficult to separate between two iris formats furthermore less touchy to clamor appeared in Fig. 5 below.

2.4 Feature extraction and encoding

For easy and smooth comparisons of Iris only the significant features of the Iris needs to be encoded so as to find the uniqueness of the iris which helps in the formation the signature. The structured features and patterns of the Iris should consist of ample information to differentiate among various Irises and should be less sensitive to different levels of noises. The Fig. 6 shows how the area of interest or Iris portion that is to be matched is taken out. Duagman Rubber sheet Model has been used to extract the features that resides in the Iris[1,2].

In the correlate part of the iris some portion is in it are white while rest of the bit is dark .The dark areas means the territory for coordinating which is our Region of Interest in this paper while the white districts of associate indicates noises or unwanted which is undesirable for our study given in figure below[1,2].

2.4.1 Encoding

The basic theory behind applying the Gabor filter is to break up the 2 Dimensional normalized pattern or features into a number of 1 Dimensional wavelets, and then these signals are convolved with 1D Gabor wavelets. Gabor filters are generally useful for extracting local value information. Here in this present paper Log-Gabor filter is applied as to obtain a zero DC component for any bandwidth. The frequency response of a Log-Gabor filter[2,6] is given as

$$G(f) = \exp\left(\frac{-(\log(f/f_0))^2}{2(\log(\sigma/f_0))^2}\right)^2$$

where f_0 represents the centre frequency and σ gives the bandwidth of the filter.

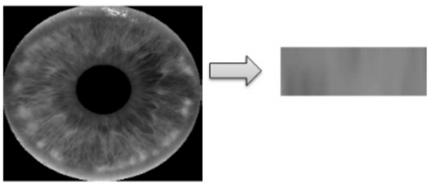

Fig. 5. A Rectangular Portion of Iris Area Being Extracted.

Fig. 6. Black Areas Denotes Area Required for Matching and White Region Denotes the Noise.

Table 1. Table of Comparative Study.

Methodology	Rate of Accuracy	Average Time	Rate of Matching Accuracy
Daugman	78%	88	100%
Masek	84%	101	88.25%
Wildes	85%	68	90.2%
Proposed	90.36%	48	94%

3. Matching

The matching between the two irises is computed by Euclidean distance which helps to find out the similarity measure between two irises[4]. A distance of zero signifies a perfect matching output whereas the level of distance directly measures the amount of dissimilarity of two irises. With dimension of feature vectors this Euclidean distance performs best results.

Let P and Q are two points in the Euclidean Space Where $P = P_1, P_2, P_3 \ldots, P_n$ and $Q = Q_1, Q_2, Q_3 \ldots, Q_n$.

Then distance from P to Q is given by:

$$X = \sqrt{(P1 - Q1)^2 + (P2 - Q2)^2 + \cdots (Pn - Qn)^2}$$

For more simplification the distance Checks the Square root of differences between coordinates of a pair of objects.

$$D = \sum_{i=1}^{n} Q_i - P_i$$

4. Results

100 iris images from CASIA database are used for training and observed that this experiment gives 95% of output in matching standards. So the voter Registration list is prepared by giving a unique number to the entire iris image in the database. During the polling time the person who is a citizen of India will have to match his identity and see the result. If the iris matches with the number in registration list then this person is authenticated else is considered as fraud.

5. Conclusions

The present work is very much novel and expected that this study would provide some high accuracy implementation of security systems. And as Electoral processing system needs very high security measures it will be very much beneficial to nation to process the system smoothly by creating a total fraud free voter registration list. Moreover this system can also be implemented where high security threats prevail which are prone to unauthenticated uses of different systems. This area of works needs a constant improvement in the matching and recognition part as to have a efficient and better recognition rate.

References

[1] R. Wildes, J. Asmuth, G. Green, S. Hsu, R. Kolczynski, J. Matey and S. McBride, A System for Automated Iris Recognition, *Proceedings of IEEE Workshop on Applications of Computer Vision*, Sarasota, FL, pp. 121–128, (1994).

[2] Libor Masek, Recognition of Human Iris Patterns for Biometric Iden-tification, *School of Computer Science and Soft Engineering*, The University of Western Australia, (2003).

[3] R. C. Gonzalez and R. E. Woods, Digital Image Processing, 2nd ed., *Prentice Hall*.

[4] J. Daugman, How Iris Recognition Works, *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 14, no. 1, pp. 21–30, January (2004).

[5] J. Mira and J. Mayer, Image Feature Extraction for Application of Biometric Identification of Iris: A Morphological Approach, In *IEEE Proceedings XVI Brazilian Symposium on Computer Graphics and Image Processing*, pp. 391–398, (2003).

[6] Satyanarayana V. V. Tallapragada and E. G. Rajan, Article: IRIS Recognition Based on Non Linear Dimensionality Reduction of IRIS Code with KPCA.

[7] A. Abhyankara and S. Schuckers, A Novel Biorthogonal Wavelet Network System for Off-angle Iris Recognition, *Pattern Recognition*, vol. 43, pp. 987–1007, (2010).
[8] E. M. Arvacheh and H. R. Tizhoosh, Iris Segmentation: Detecting Pupil, Limbus and Eyelids, *Proceedings of International Conference on Image Processing*, pp. 2453–2456, (2006).
[9] J. Daugman, New methods in Iris Recognition, *IEEE Transactions on Systems, Man, Cybernetics B*, vol. 37(1), pp. 1167–1175, (2007).
[10] J. Daugman, High Confidence Visual Recognition of Persons by a Test of Statistical Independence, *IEEE Pattern Analysis Machine Intelligence*, vol. 15, pp. 1148–1161.
[11] J. Daugman, Biometric Personal Identification System based on Iris Analysis, *United States Patent*, Patent Number, vol. 5, pp. 291–560, (1994).
[12] L. Ma, T. Tan, Y. Wang and D. Zhang, Personal Identification based on Iris Texture Analysis, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 25, no. 12, pp. 1519–1533, December (2003).